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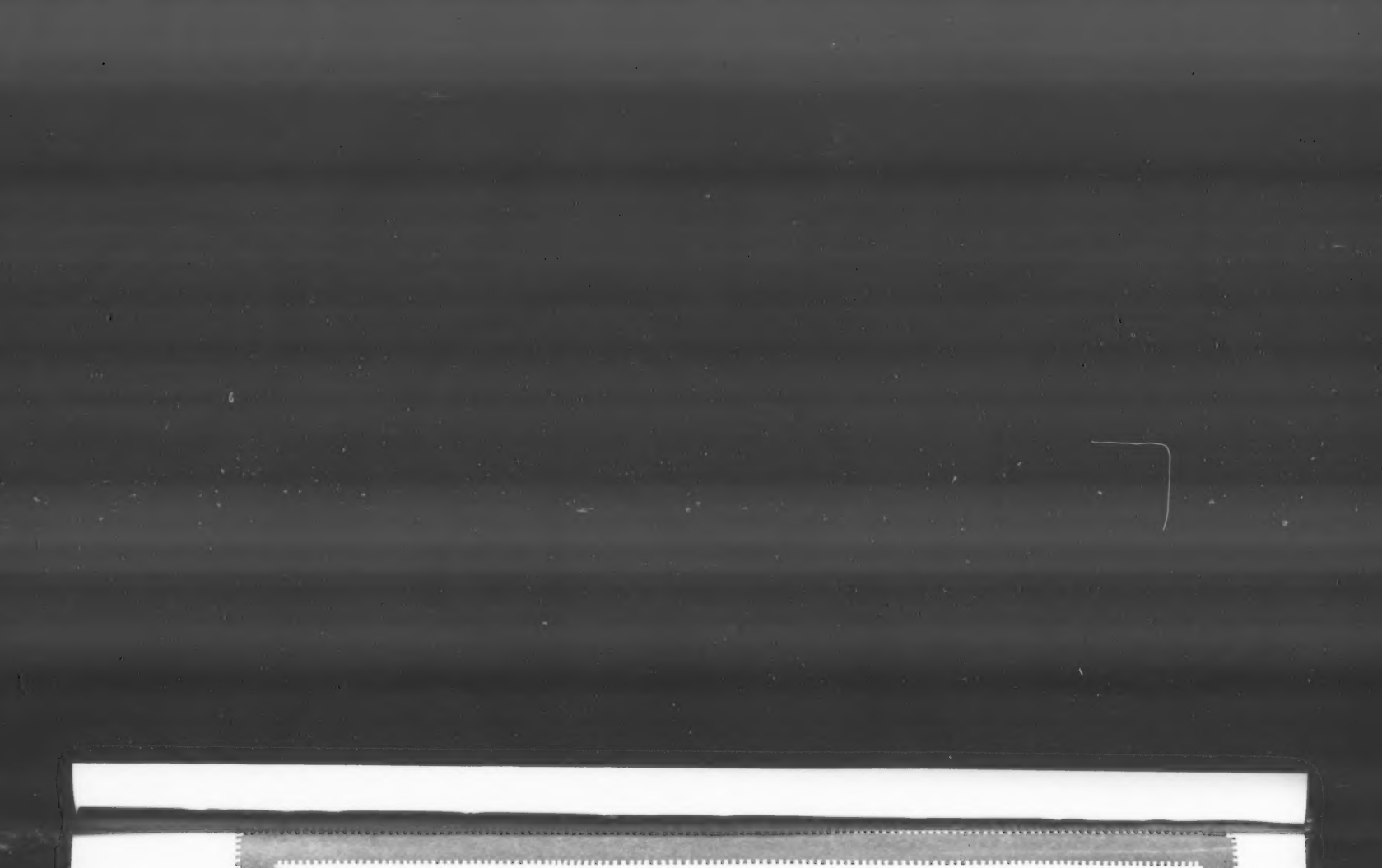

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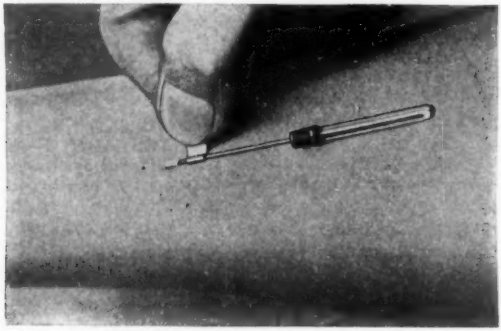

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THE

AMERICAN JOURNAL

OF THE MEDICAL SCIENCES

SEPTEMBER, 1915

ORIGINAL ARTICLES

A CONTRIBUTION TO THE PARALYTIC AND OTHER PERSISTENT SEQUELÆ OF MIGRAINE.*

By J. Ramsay Hunt, M.D.,

CONSULTING NEUROLOGIST, NEW YORK NEUROLOGICAL INSTITUTE.

I. Introduction.
II. Migraine and ophthalmoplegia.
III. Migraine and permanent hemianopsia.
IV. Migraine and hemiplegia.
V. Migraine and optic nerve lesions.
VI. Concluding remarks.

I. Introduction. In the vast majority of cases, a tendency to migraine entails no more serious consequences than the recurrence of periodical headaches of varying degrees of severity. Headaches of this character are often associated with curious transitory focal symptoms, *e. g.*, scotoma, hemianopsia, hemiparesis, and hemiparesthesia. More rarely evanescent aphasic attacks and mental disturbances accompany the seizure. These focal manifestations are purely functional in nature and disappear promptly with the subsidence of the other symptoms of the paroxysm. They are generally regarded as manifestations of vascular spasm, and this theory is in harmony with their temporary and evanescent nature.

Attacks of this character may recur over a period of many years and yet leave no permanent mark or symptom. Unfortunately, this is not always true, and in rare cases permanent and often serious consequences ensue.

* Read at a meeting of the American Neurological Association in New York, May 6, 1915.

The paralytic and other permanent complications of migraine may appear in various forms, viz., as ocular palsies (*migraine opthalmoplegique*), organic hemiplegia with aphasia, hemianopsia, and optic atrophy. A recurrent facial paralysis has also been ascribed to migraine (*facioplegic-migraine*), presumably of the same nature and having the same pathogenesis as the opthalmoplegic type of this affection.

The object of this study is to record my personal experience with a comparatively rare group of cases, and to emphasize the clinical fact that migraine, which is usually so harmless, may on occasion be the cause of serious and permanent sequelæ.

II. MIGRAINE AND OPHTHALMOPLEGIA.

CASE I. *Summary. Migraine in a woman, aged twenty-five years; following typical unilateral headache, developed complete paralysis of the left third nerve; recovery. One year later another migrainous seizure, followed by incomplete palsy of the right third nerve; recovery.*

History. Mrs. B., aged twenty-five years, married; has a child two years old; no miscarriages. No history of lues. Since birth of child has been subject to periodical headaches, which are always unilateral in character, and usually precede but sometimes follow the menstrual period. The pain is most severe in the temporal region, extending into the eye. The attacks are accompanied by nausea and often vomiting. There are no scotomata, or paresthesiæ, during the seizure. In severe attacks the pain lasts from two to three days. Her mother and one sister are subject to periodical headaches. An uncle on the father's side was epileptic.

The Attack. From August 8 to August 10, 1901, she had a severe unilateral headache of the usual migrainous type. On August 11, double vision and a drooping of the left eyelid appeared. The following morning there was complete ptosis on the left side. The pain was very great and centred chiefly in the left temporal region and eye.

Examination (August 16, 1901). Patient still suffers from severe pain in the left temple and eye. There is complete ptosis, with paralysis of the superior, inferior, and internal recti muscles on the left side. There is good movement of the external rectus and superior oblique. The pupils are equal and react promptly. No paralysis of accommodation. Ocular excursions of the right eye are normal. Other cranial nerves are negative. Optic disks are normal. General sensibility is normal, and there is no weakness of the extremities and no hemianopsia. The tendon and skin reflexes are present, and of equal intensity on the two sides; no Babinski. Heart action is normal. Urine is free from albumin and sugar.

August 28. Still has neuralgic pain in the left temple, forehead, and eye. There is considerable improvement in the ptosis and in the muscular movements supplied by the left third nerve.

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January 3, 1902. Patient is still subject to periodical headaches at the time of the menstrual period. There is no trace of the former ocular motor palsy. She states that on December 25 she noticed some transient drooping of the left eyelid during a migraine paroxysm, but without diplopia.

Second Attack (November 4, 1902). The patient returns with the statement that she has had much less headache during the past few months, which is attributed to a gynecological procedure (dilatation of the cervix and curettage).

A few days ago, following a severe migrainous attack with the usual pain, on this occasion localized in the right temple, there appeared diplopia, but without ptosis. Dr. Alexander Duane, who made the ophthalmological examination, reports paresis of the right inferior rectus and inferior oblique muscles. Pupils are equal and react normally. The optic disks are normal. The paresis and accompanying diplopia disappeared during the course of the next few weeks.

COMMENT. This case may be regarded as a fairly typical example of the ophthalmoplegic migraine. A woman with hereditary hemicrania, develops during the paroxysm an oculomotor palsy. As is so common in the clinical history of this group of cases the pain was of the circumscribed variety, and localized chiefly in the temple and eye of the affected side. It was intense and very persistent. Of special interest is the alternation of the paralytic manifestations, appearing first on the left and then upon the right side. The recovery after both attacks was complete.

CASE II.—*Typical migraine since childhood; at the age of forty-three years had an attack of complete third nerve paralysis, with recovery; a subsequent attack which proved fatal; cardiovascular complications.*

History. A woman aged forty-three years; single; since childhood she has been subject to recurrent attacks of migraine. (A sister also suffers from migraine.) The headaches are always unilateral and usually upon the left side. When severe there is the usual termination in nausea and vomiting. In recent years the attacks have diminished in severity. As a rule the seizure is ushered in by scotoma (lights and colors). Between the paroxysms she is entirely free from cerebral symptoms. The menses still persist and are irregular. She states that for the last three years after very severe attacks there has usually been some *drooping of the left eyelid,* which would pass off in the course of a few days. There was never diplopia. During the past three months she has been subjected to a severe nervous strain, due to the serious illness of a parent.

The Attack. On June 23, 1909, she was seized with one of her usual headaches, which was preceded by the visual aura. The pain was situated in the left side, and was very severe. Late in

the night it culminated in an attack of nausea and vomiting, after which she fell asleep. On awaking the next morning there was complete ptosis of the left eyelid, and on raising the lid she saw double. There was also a unilateral "drawing" sensation over the left side of the brow.

Examination (July 27, 1909). There is complete third nerve paralysis on the left side, with ptosis and dilatation of the pupil. All other motor cranial nerves are normal. There is slight hyperesthesia over the left brow, strictly limited to the supraorbital distribution of the fifth nerve. The left supraorbital reflex (McCarthy reflex) is absent. The optic nerves are normal. The right pupil is of normal size and reacts promptly to light and accommodation. The left pupil is widely dilated and stiff. The various tendon and skin reflexes are present and normal. No Babinski. Sensation and motion of the extremities are normal. Heart: There is a systolic bruit over the aortic cartilage and an accentuation of the second aortic sound. Systolic blood-pressure registers 200 millimeters. The urine contains a few hyaline casts and a trace of albumin. The Wassermann test is negative.

Subsequent History. The family physician reported that the third nerve paralysis cleared up completely in the course of three months.

A few months after her recovery, following a severe headache, there developed bilateral ocular palsies which terminated fatally; unfortunately, no more detailed information could be obtained of the symptomatology during this last attack.

COMMENT. This patient presents a classical history of migraine extending over a period of many years. In her forty-third year, after a typical paroxysm, a total left-third nerve palsy supervened from which she eventually recovered. In the subsequent attack, which was bilateral and progressive, she died. Even previous to the first attack she had noted after severe headaches a slight drooping of the left eyelid, which would pass off in the course of a few days. In the light of later events this may be regarded as an important warning signal of the paralysis which subsequently ensued. The great importance of cardiovascular changes as an etiological factor in this case cannot be questioned, and the occurrence of high blood-pressure and vascular degenerations in migraine should be regarded as complications with very serious possibilities.

It is interesting to recall in this connection the belief of some authorities, that prolonged and recurring attacks of vasomotor explosions such as take place in migraine over a period of many years are in themselves an adequate cause for the production of cerebral arteriosclerosis.

CASE III.—*Summary: The occurrence in two sisters with migraine of isolated abducens palsy developing during the attack; recovery.*

History. The patient is forty-seven years of age and a trained nurse. She has suffered from migraine since childhood. The

attacks are peculiar in that the pain is always strictly localized, usually in the temple and brow of the left side. Very rarely the pain has appeared upon the right side, in which event it was always strictly limited to the region of the temple and brow. As a rule the paroxysms begin in the morning, lasting several hours and sometimes an entire day, but scarcely ever longer. After a night's rest she awakens free from pain. Toward the end of the paroxysm there is the usual nausea and often vomiting. The vision is a little blurred during the attack, but there is no scintillating or color scotoma, and no hemianopsia. These headaches are usually associated with the menstrual period, and since childhood intermissions longer than two or three months have been very rare. There is a strong family tendency to migraine, and her mother and four sisters have all been sufferers from this malady.

At the age of thirty she developed symptoms of exophthalmic goitre, which was treated surgically eight years ago by partial thyroidectomy; since which time she has been practically free from the symptoms of this disease. The menses were regular and normal up to a few months ago, when symptoms of the menopause made their appearance. She has been under severe nervous strain during the past year, caused by illness and death in her family.

The Attack. On January 26, 1912, she was seized with one of her usual headaches, the pain being situated in the right temple. The attack, however, instead of lessening after a few hours, as was usual, increased steadily in intensity and persisted, requiring frequent doses of codein and morphin for the alleviation of the pain. On February 1 diplopia appeared, with paresis of the right external rectus muscle. The pain was still severe and was localized in the temple and brow.

Examination (February 2). Pain is still severe and persistent; it is sharp and boring in character in the right temporal region, and there is complete paralysis of the right external rectus. All the other cranial nerves, including the optic nerves, are normal. Pupils are equal and react to light and accommodation. The corneal and conjunctival reflexes are present and equal on the two sides. No tenderness over the points of exit of the fifth nerve, and the sensation of the face is normal. Motor power and sensation of the extremities are normal. The tendon reflexes of the arms and legs are present and equal on the two sides. Skin reflexes are present. No Babinski. Heart and lungs are normal. The urine is normal. Rhinological examination shows no evidences of sinus disease. The Wassermann test is negative.

February 7. Has had almost continuous pain in the right side of the forehead, temple, and eye, requiring morphin. Pain of late has manifested a tendency to settle in the depths of the right eye, and there is marked photophobia. Complete abducens palsy on the right side persists, otherwise a general neurological examina-

tion is negative. On February 8 the pain shifted to the trigeminal area on the right side and is felt in the teeth and gums. After this the pain gradually moderated from day to day, and at the end of two weeks had completely disappeared. On April 1 she returned to her work. There is still paresis of the right external rectus, and she wears a ground glass to counteract the diplopia. She has had only one slight temporal headache since the last examination.

A few weeks later the diplopia disappeared, with complete restoration of function in the paralyzed rectus muscles.

October 14, 1914. She has continued her occupation and has never had any return of headaches or diplopia. The vision and ocular excursions are normal.

CASE IV.—A sister of the above patient, unmarried and forty-five years of age, has likewise been a sufferer from migraine since early childhood. The attack begins with pain in the temple, which gradually extends over the whole head. There is usually nausea and vomiting, and the severest pain is localized in the temporal region. There are no paresthesiæ and no visual disturbances in the attacks, which usually occur at the time of the menstrual period. During the past year, like her sister, she had been subjected to a severe nervous strain, nursing her mother during a long illness, which terminated fatally.

The Attack. Early in October, 1911, she was seized with one of her usual headaches, beginning in the left temple. It was of unusual severity and persistence, and was accompanied by vomiting. After the paroxysm had lasted several days, double vision made its appearance, and an oculist was called in consultation, who found an isolated paralysis of the left external rectus muscle; the fundi were negative and the other muscular movements were not affected. She wore a ground glass to counteract the diplopia, which did not disappear until the following April. Recovery was complete. There has been no recurrence of the paralysis since. Periodical unilateral headaches still recur at intervals.

COMMENT. These cases are of unusual interest on account of the extreme rarity of this ocular complication, and because of its occurrence in two sisters, in both consequent upon a migraine paroxysm. Such a familial coincidence is, I believe, unique, and would speak for the joint inheritance of a highly specialized type of this disease or of some vascular anomaly. It is significant that both cases had passed the middle period of life and had reached the age when organic vascular changes are likely to appear. Under these conditions a certain vasular distribution which for many years had been subjected to periodical spasms, with only functional disturbances, might at last, because of diminished caliber or elasticity of the vessel wall, give rise to organic changes from too prolonged obstruction of the blood current. It is interesting to note that in addition to the age factor, both sisters had been subjected to unusual worry and

strain consequent upon the illness and death of a parent. The exact localization of the lesion in such cases is difficult to determine. The theory of a neural origin finds most favor, caused either by pressure or traction from swelling of the surrounding parts or by prolonged spasm of the vasa nervorum with consecutive ischemic degenerative changes in the nerve.

Remarks on Ophthalmoplegic Migraine. Ophthalmoplegic migraine has occupied a definite place in medical literature since the original contributions of Moebius[16] and Charcot[5] to this subject. The periodical oculomotor palsies, as they were first termed by Moebius, are at the present time regarded by most writers as allied to if not identical with the *migraine ophthalmoplegique*, as described by Charcot.

Two clinical types of this affection are recognized by systematic writers: a recurrent or periodical ocular palsy followed by complete recovery, and periodic exacerbations of a preëxisting paralysis of some of the branches of the third nerve.

This latter type has usually been associated with some organic lesion of the nerve or near the nerve at the base of the brain. In the few autopsies of this condition which are on record a variety of pathological conditions have been found. In the Thomsen-Richter[26] case a fibrous sarcoma was found attached to the third nerve, while in that of Karplus,[14] a neurofibroma of the dura had caused pressure on the nerve from below. In the Weiss[31] case a granuloma nodule was demonstrated on the nerve. In a more recent pathological contribution to the subject by Shinoya[24] there was a history of periodical oculomotor palsy beginning at the age of six; between the attacks remnants of the palsy persisted. Post-mortem examination showed a fibrous-like swelling on the right third nerve, situated just behind the posterior cerebral artery. In the discussion of this case, emphasis is placed upon the fact that the third nerve passes between two arteries in its course at the base of the brain, the posterior cerebral and the superior cerebellar and that this may account for the very curious predisposition of this nerve to such lesions. Harvey Cushing[7] has also called attention to the possibility of vascular pressure and constriction as a cause of the neural complications of migraine.

The oculomotor paralysis in such cases may be complete as in Case II of my series, the paralysis involving both the intrinsic and extrinsic muscular mechanism, or it may be limited to the external muscles, as in Case I. Cases have also been described (Oppenheim[18]) in which only the intrinsic muscular mechanism was affected with paralysis of the iris and ciliary muscles.

An isolated palsy of the trochlearis muscles following migraine may also occur and is excessively rare, only two cases are recorded in the entire literature of this subject (Luzenberger[15] and Bornstein[1]).

Isolated paralysis of the sixth nerve associated with migraine is second only in rarity to trochlearis palsy; such cases have been observed by de Schweinitz,[8] Veasey,[27] Omerod and Holmes-Spicer,[17] Brav,[4] Oppenheim,[19] and Bornstein.[2]

In the case recorded by de Schweinitz the first attack occurred in a child only one year old, suggesting the recurrent oculomotor palsies which so frequently begin in childhood. In Bornstein's case the paralysis appeared as late as the sixtieth year. In the case described by Brav, both the migraine and the subsequent sixth nerve paralysis were peculiar, in that recurrences were observed only after parturition.

Not only are isolated palsies of the individual ocular nerves described in this affection, but they may be present in all possible combinations, even to the extent of complete opthalmoplegia (Brissaud[3]). Paderstein[21] has observed a combined abducens and trochlearis palsy in a migrainous woman of twenty.

In Cases II, III, and IV of my series, the ocular palsy first made its appearance in the middle period of life and should therefore be regarded as an accidental paralytic complication, such as will be described later in other arterial distributions, and not as a true relapsing or recurrent ocular palsy of the type of Moebius. They are cases of migraine with opthalmoplegia, rather than ophthalmoplegic migraine.

III. Migraine and Permanent Hemianopsia.

Case V.—*Summary. A man aged forty-four years, had suffered from migraine since childhood; after a typical attack there developed a right homonymous hemianopsia, which persisted.*

History. Mr. G., aged forty-four years; contractor by occupation. His father died at the age of seventy-nine years of a paralytic stroke; his mother is still living. There is no history of migraine in the family. He denies any venereal infection, and is the father of seven healthy children.

When two years of age he received an injury to the head, fracturing the frontal bone. There is still a slight depression in the frontal region, the result of this injury. Soon after this he developed epileptic seizures, which persisted to the age of six, after which time he had no subsequent attacks. At the age of thirty he received an injury to the right eye, which left a slight haziness of the cornea. From childhood he has been subject to typical attacks of migraine. These were severe up to his thirtieth year, after which they diminished somewhat in intensity. With the attack there is sometimes, but not always, a visual aura (lights and colors). The attack is usually accompanied by nausea, and frequently terminates in vomiting. He states that on a few occasions during the height of the pain paroxysm he seemed to loose consciousness, which he attributes to the agonizing intensity of the pain. He has noticed during the past year that in the attack or immediately preceding

it the right hand becomes heavy and numb. This lasts for about fifteen minutes. There was no aphasia.

The Attack. On October 24, 1905, he was seized with one of his usual headaches. It was very severe, and, as was usual under these conditions, he went to bed. On awaking the following morning he was free from pain, but vision was very hazy and indistinct. He thought it must be still dark. Gradually during the day the vision improved, but there remained a persistent defect in the right visual field. He had no paralysis; no paresthesia, and no speech disturbance.

Examination (February 8, 1906). The pupils are equal, the left somewhat wider than the right. The reactions are perfect to both light and accommodation. No nystagmus. Opacities are visible in the left cornea. There is no paralysis of any of the cranial nerves, and the movements of the extremities are normal. The general sensibility is unimpared. The tendon reflexes of the arms and legs are present but more active on the right side. There is no Babinski.

The fields of vision show a partial homonymous hemiopic defect on the right side. The hemiopic pupillary reaction is not demonstrable. The optic disks are normal. In the blind area the sensation is not one of darkness but simply the absence of visual perceptions.

The heart is free from murmurs and the muscular tone is of good quality. No accentuation of the second aortic. Pulse is regular and soft. The urine is free from albumin or sugar. (Note: A written communication received from the patient in 1910, four years subsequent to this examination, states that the half-blindness still persists and that he is occasionally subject to attacks of migraine, although much less frequent and severe.)

COMMENT. The character and periodicity of the headaches in this case are typical of migraine. For one year previous to the development of hemianopsia he had noted during the attack a transient sensation of numbness and heaviness in the right hand which had never occurred previous to this time, and may well be construed as a warning symptom of the subsequent vascular lesion. Immediately following a typical attack he awakened to find the hemiopic defect in the right field of vision which has persisted. This was the only residual symptom of the attack, and indicates a lesion of the visual mechanism in its course behind the optic chiasm. As there was no haziness or darkness in the blind area, as usually occurs in lesions of the optic tract and chiasm, it may be assumed that the lesion was posterior to the primary optical centres, probably in or near the cortical area for vision. The absence of the hemiopic pupillary phenomenon is also in favor of a central and not a peripheral localization of the injury. The manner of development is strongly suggestive of thrombosis,

although a hemorrhage cannot entirely be excluded. Such an attack must be directly attributed to the explosive disturbances of vasomotor function which occur in migraine. It is probable, however, that beginning vascular degenerations were of importance as a predisposing factor.

CASE VI.—*Summary. Severe migraine since childhood; at the age of forty-five, during an attack, developed a left homonymous hemianopsia lasting ten days, followed by recovery; eight months later a second attack, which was persistent; mitral disease.*

History. Patient is a woman, aged forty-five years; married; has had two miscarriages; no children. Her mother and two sisters have migraine. No history of epilepsy. Since childhood she has been subject to periodical attacks of hemicrania. The attack usually begins with vertigo. Pain is localized over the left brow and temple, and when severe may last two or three days. Occasionally the pain passes into the eyes and the bridge of the nose. There is usually nausea (churning sensations), but no actual vomiting. The attack occurs, as a rule, once a month, usually at the menstrual period. Often during the paroxysm the three ulnar fingers of the right hand become numb, but there is no weakness and no aphasia. Toward the end of the seizure she often sees bright lights of bizarre and striking form (scintillating scotoma).

The Attack. On March 9, 1906, during a severe attack, which had begun in the usual manner, there occurred a blurring of the left field of vision, which lasted ten days and then gradually faded away. Periodical headaches continued regularly after this attack, and were accompanied by numbness in the fingers of the right hand and a sensation as if the sight were going. Between the attacks she felt well and the vision was normal.

Second Attack. On October 27, 1907, she had a terrific headache; the pain was localized in the occipital region, and extended over the vertex into the eyes and the bridge of the nose. There was dizziness and nausea. In the attack a left-sided blindness appeared which has persisted up to the present time.

Examination (November 22, 1907). Pupils are unequal, the left being wider than the right; they react to light and accommodation. Fundi are normal. The cranial nerves are negative. The general motility and sensations are undisturbed. No Babinski. There is a well-marked homonymous defect in the left fields of vision. Heart: A musical, systolic murmur at the apex with hypertrophy of the left ventricle (mitral regurgitation).

Note: The hemianopic defect was still present in January, 1909, and she still suffers occasionally with headaches, which are less severe.

COMMENT. This case bears a close resemblance to the preceding one. Both patients were in the fourth decennium of life, and had suffered from migraine since childhood. In the first case the

warning symptoms during the attack consisted of paresthesiæ and heaviness of the hand, while in the second the permanent hemianopsia had been preceded by transient attacks, one of which had lasted ten days. As mitral disease was present in this case, the question of embolism of the occipital branch of the posterior cerebral artery was considered, but finally discarded in favor of thrombosis because of the preliminary attacks of threatened occlusion, and also because of the etiological relationship between the migraine paroxysm and the organic defect, both of which favoring the probability of thrombosis.

Permanent hemianopsia following migraine is fortunately a rare complication. The residual defect may be a complete homonymous hemianopsia or a partial loss only may result, as in Case V of my series. This danger of the so-called ophthalmic migraine was originally emphasized by Charcot, and cases illustrating such permanent visual defects have been described by Charcot,[6] Féré,[9] and von Schroeder.[28]

In this country the subject has been presented in an able monograph by Dr. J. J. Thomas,[25] of Boston, who has personally observed three cases. In his observations, in addition to the hemiopic defect, there was associated a moderate degree of hemiplegia. T. A. Williams[32] has also recorded an interesting observation, in which migraine with hemiopic scotoma as an aura finally terminated in permanent hemianopsia.

IV. Migraine and Hemiplegia.

Case VI.—The patient is a single woman, aged thirty-two years, who had been subject to migraine since childhood. Her mother and other members of the mother's family have also been victims of this malady. The attacks are typical in nature, the pain being most severe in the occipital region, and usually terminate with nausea and vomiting.

The Attack. Early in August, 1912, while travelling, she was seized with a severe occipital headache of usual character, which terminated in vomiting. A physician was called and she was given hypodermics of morphin to relieve the pain. The following day the headache was better, and in the course of a week she had regained her usual health. Three weeks later she had another severe attack of pain in the occipital region, which likewise came on while travelling. She got up in the night in order to vomit and fainted. On arriving in New York she was taken to the New York Hospital in a semiconscious state.

Examination (September 7, 1912). She is semiconscious and can be aroused with difficulty, but immediately relapses into stupor. There is slight stiffness of the neck and a distinct paresis of the left arm and leg, with a corresponding weakness of the left face. The tongue deviates toward the left. The abdominal reflexes are absent on the left side and the Babinski is present

on both sides. No paralysis of the cranial nerves. The heart is free from murmurs. The pulse is rapid and the respirations are increased in frequency and at times irregular. Lumbar puncture shows the presence of fresh blood. This was repeated on four other occasions, and always with the same result. The Wassermann test of the blood and cerebrospinal fluid was negative. Blood cultures and cultures of cerebrospinal fluid were also negative. The urine was normal. There was a leukocytosis of 16,000, with 86 per cent. polynuclears. Examination of the nasal sinuses was negative.

At the end of twenty-four hours the stuporous condition diminished and was replaced by a restless delirium. She had at no time any convulsive seizures. As the mental condition improved it was noted that in addition to the left hemiplegia there was also hemianopsia upon the left side. At this time an ophthalmic examination showed a slight degree of optic neuritis, a little more pronounced in the right than in the left eye.

Her mental condition gradually cleared and the hemiplegia and hemianopsia gradually diminished and she eventually made a complete recovery.

COMMENT. The diagnosis in this case was at the time and still is somewhat doubtful. The complete recovery is in favor of a vascular lesion. There is no question as to the existence of migraine in this patient, and of a strong family tendency to this disease. There seems also very little doubt that the apoplectiform seizure was the culmination of a severe migrainous paroxysm, and while there may have been some preëxisting vascular or other organic defect of the brain structure, the determining role played by the migraine explosion seems to have been a perfectly definite one.

Cases of migraine which have terminated in hemiplegia have been described by Féré,[10] von Schroeder,[28] Oppenheim,[20] and Infeld.[29]

Oppenheim's case was that of a woman who had suffered from migraine since childhood. Four months after giving birth to a child she had an attack of migraine with aphasia, which cleared up in twenty-four hours. She subsequently had four similar attacks of transient aphasia, all occurring after paroxysms of migraine. In the last attack there was aphasia and a right hemiplegia with delirium which terminated fatally. The autopsy showed an area of softening in the left cerebral hemisphere, produced by thrombosis of the left internal carotid near the origin of the Sylvian artery. Microscopically, the vessel wall showed a distinct endarteritis, with thickening of the adventitia, so that in this case there was evidently a preëxisting organic defect in the vessel wall which could not withstand the acute vascular disturbances consequent upon an attack of migraine; and while migraine was by no means the sole cause of the accident, it was a strongly determining factor.

Von Schroeder has described a somewhat similar case in a man, aged thirty years, who had been subject to attacks of ophthalmic migraine since his twentieth year. Following a series of severe attacks, all typical in their manifestations, he suddenly lost consciousness and developed a left hemiplegia. On recovering consciousness he was found to have in addition to the paralysis a left hemianopsia. The hemiplegia improved but the hemianopsia persisted as a permanent defect.

Infeld has also described the case of a woman, aged twenty-nine years, a sufferer from migraine since her twelfth year. Following a migraine paroxysm she developed a right hemiplegia which gradually improved but left in its wake persistent weakness, paresthesiæ, and athetosis of the right hand.

V. Migraine and Lesions of the Optic Nerve.

Summary: A woman, aged thirty-one years, subject to migrainous seizures since childhood; after a severe attack she developed a unilateral retrobulbar neuritis with paracentral scotoma; recovery.

History. The patient is a woman, aged thirty-one years; single; for many years under my care for migraine and various neurasthenic symptoms. She has been almost completely deaf since her fifteenth year (otosclerosis). She has also a congenital ocular palsy, involving the left external and both internal recti muscles. A brother and one sister have also congenital defects of the ocular muscles. As her deafness progressed she became suspicious, irritable, and peculiar, and at the age of twenty-five developed a delusional state with ideas of persecution, from which she recovered in the course of a few months. Since her thirteenth year she has been subject to typical attacks of migraine, with scotoma and vomiting. After the twenty-first year these attacks have recurred periodically, but are much milder in character. They begin in one temple and gradually become diffused over the entire head.

The Attack. On February 18, 1912, she had a severe migrainous seizure, beginning in the right temple and rapidly extending over the entire head. Pain was especially excruciating in the region of the right temple, and radiating into the right eye. To relieve this pain she took during the course of the night 20 grains of pyramidon in divided doses. In the night she vomited, after which she felt somewhat better and fell asleep. The following morning (February 19) on awaking, she found the vision in the right eye was hazy and blurred, and as if looking through a veil. The vision in the left eye was perfectly normal. The movements of the right eye were slightly painful and the eyeball somewhat tender to pressure.

Dr. J. Wolf made an ophthalmoscopic examination at this time and found a slight congestion and haziness of the right optic nerve. The right field of vision showed a relative scotoma in the centre and to the temporal side of the fixation-point (paracentral scotoma). Vision: O. D., 15/15.

February 22. Can scarcely count fingers with right eye. Eyeball still slightly tender.

March 4. Vision is showing some improvement.

March 7. Vision: O. D., 15/20. Still paracentral scotoma.

April 19. Central vision normal. The acuity of the periphery is still somewhat diminished (veiled), but the peripheral limits of vision are normal. In the right eye there is a very faint pallor of the optic nerve. Diagnosis retrobulbar neuritis. The rhinological examination, including illumination of the sinuses, was also found negative (Dr. J. Wolf). Roentgenogram of the sinuses showed no pathological changes.

The urine is normal; heart is normal.

COMMENT. This case is recorded because of the apparent relationship of unilateral retrobulbar neuritis to a migraine paroxysm. Such a sequel is not recognized by systematic writers on this subject.

Oppenheim,[19] however, states that he "once observed a patient with migraine who developed an optic neuritis with paracentral scotoma, and although the causal relationship may be doubtful, it is well to bear in mind the probability of such a complication."

Other migraine complications referable to the optic nerve are, however, definitely recognized. For example, Voss[30] has observed unilateral optic atrophy after the attack in a woman who had reached her forty-second year. She had been subject to hemicrania since childhood, and following a severe attack became suddenly blind in one eye. This was caused either by hemorrhage into the optic sheath or thrombosis of the central artery of the retina. Galezowski[12] has also observed thrombosis of the central artery of the retina from a similar cause. In this connection it is of interest to note that hemorrhages into the retina and detachments of the retinal membrane have occurred during the migraine paroxysm.

VI. CONCLUDING REMARKS.

Without reviewing in detail, all the theories which have been formulated in explanation of the symptomatology of genuine migraine, it may be assumed that there is periodical recurrence of an autointoxication, the chief effects of which are experienced by the sympathetic and vascular systems. As a result of this there is induced a condition of more or less localized vasomotor spasm or vasomotor dilatation of the cerebral circulation (angiospastic and angioparalytic types of migraine).

Some idea of the degree of vasomotor disturbance to which the cerebral vessels are subjected may be surmised from the results of opthalmoscopical examination of the retinal circulation during the attack. At such times there has been frequently noted a marked pallor of the optic nerve and retina, from contraction of the vessels, which gradually disappears with the subsidence of

the seizure. The fluctuations in the size of the temporal artery during the paroxysm is so well known as scarcely to require mention.

It would seem reasonably safe to assume that what occurs in the distribution of the ophthalmic and temporal arteries may also occur in other regions of the cerebral circulation, and this vascular spasm is regarded by most observers as the cause underlying the transient focal symptoms so frequently associated with this disease, viz., scotomata, paresthesiæ, paresis of the extremities, and aphasia, all of which disappear with the subsidence of the spasm.

Another important and interesting question is the etiological relationship of hemicrania to premature cerebral arteriosclerosis. Some writers maintain that the frequent recurrence of vascular explosions in migraine over a period of many years are in themselves sufficient to cause cerebral arteriosclerosis. The auto-intoxication which is the underlying basis of the disease is also recognized as a probable contributing factor.

Of great importance from the stand-point of the permanent sequelæ such as are described in this paper is the question of the influence of recurring attacks of migraine upon an already existing arterial sclerosis. It is very evident that in the presence of cerebral arteriosclerosis, however slight, that crises of hemicrania are much more likely to be the cause of vascular accidents, such as thrombosis and hemorrhage than would be the case in perfectly normal vessels. It is this combination of factors which would appear to be the important one in many of the cases which have just been described.

Another element which must be considered is the possibility of arterial anomalies in the blood supply of the brain and cranial nerves which might render a certain arterial distribution especially vulnerable in the event of sudden vascular spasm.

In the recognition of migraine paralysis the essential points to be considered are: (1) the establishment of a definite clinical history of genuine or idiopathic migraine, and (2) the direct relationship of the paralysis or other complication to the migraine paroxysm. As many attacks of hemicrania begin during the day, terminating in a heavy sleep, the presence of paralysis in the morning on awakening would be strong presumptive evidence of an etiological relationship to migraine. Special emphasis should also be placed upon the presence of what may be termed "warning symptoms," *i. e.*, the recurrence of transient ptosis, diplopia, hemianopsia, hemiparesis, aphasia, and Jacksonian seizures, when such symptoms appear in middle life after a migraine paroxysm. Especially significant are such symptoms when they are foreign to the usual attack. For example, a migraine accompanied or preceded by transient hemianopsia, when this has been an early and more or less constant phenomena of the attack, would not have the same importance as when this symptom appears suddenly in middle life out of a

clear sky. On the other hand, it must be recognized that in just such cases with recurrent scotomata the danger of permanent hemianopsia is by no means a slight one.

A permanent damage to nerve structure following an attack of migraine is fortunately a rare sequel. In this group of accidents the ocular palsies rank first in importance, because of their relative frequency (migraine ophthalmoplegique). Flatau[11] in his comprehensive study of the subject has collected and analyzed 97 such cases.

Next in importance among the cranial nerve complications is the involvement of the optic nerve, *e. g.*, by thrombotic occlusion of the central artery of the retina, and possibly retrobulbar neuritis.

An importance is attached by some writers to the very doubtful association of migraine with facial paralysis (the so-called hemicrania facioplegica). This is based upon the contribution of Rossolimo,[22] who described a relapsing facial palsy in conjunction with migraine. This case stands alone in literature and, therefore, naturally awakens the suspicion of a mere coincidence, namely, the accidental association of migraine with relapsing facial palsy. It is well known that attacks of recurrent facial paralysis are by no means rare, and Bernhardt has placed the percentage as high as 7.2 per cent. of all cases of Bell's palsy. When it is still further considered that pain in the mastoid and occipital region often very severe and persistent, is one of the common symptoms of facial paralysis because of the sensory system of the facial nerve (Hunt[13]) it is evident that the pain of migraine may be closely simulated. Certainly at the present time there is no just ground for recognizing a clinical type of facioplegic migraine in the sense that we accept the *migraine ophthalmoplegique* of Moebius and Charcot.

In passing, it is of interest to recall the observation of Sil,[23] who noted a transient paresis of the hypoglossal nerve in a case of ophthalmoplegic migraine. This observation, like that of Rossolimo, is unique and in no sense constitutes a definite clinical type.

The graver paralytic complications are naturally those affecting the brain itself, and these are the result of occlusion of the cerebral vessels with consequent encephalomalacia. Such lesions have been observed in the distribution of the Sylvian artery causing hemiplegia, hemi-anesthesia, and aphasia, and in the distribution of the posterior cerebral artery when homonymous hemianopsia is the characteristic symptom. While thrombosis is the usual lesion in such cases, it is not improbable that rupture of the vessel sometimes occurs.

I am not aware of any permanent sequelæ, after an attack of migraine, which could be traced to occlusion of the vessels of the pons, medulla or the cerebellum. This is rather curious and difficult of explanation, considering the rich blood supply in this region and its frequent involvement from other causes.

It is of interest to recall that Oppenheim has described a cerebellar type of migraine in which, with the general symptoms of this disease, there were transient symptoms of cerebellar origin; so that the possibility of permanent vascular lesions of the brain stem and cerebellum having this origin, must be kept in mind.

There are two other groups of cases which should be considered from the stand-point of permanent vascular lesions, namely, the epilepsy which is so often associated with migraine and the *vertigo permanens*. Both of these conditions are usually regarded as merely functional substitutions or alternations of the neurosis itself, in other words, as a kind of migraine equivalent. And while I am heartily in accord with this hypothesis, the possibility of a permanent vascular focus resulting from an attack of migraine must be considered as a possible etiological factor in the presence of either epilepsy or persistent vertigo.

BIBLIOGRAPHY.

1. Bornstein. Migraine Ophthalmoplegique, Monatsschr. f. Neur. u. Psych., 1909, xxv, H. 3, S. 259.
2. Idem. Neur. Centralbl., 1908, xxvii, S. 972.
3. Brissaud. Leçons sur les Maladies Nerveuses, 1895, S. 364–445.
4. Brav. Ophthalmoplegic Migraine, Jour. Amer. Med. Assoc., 1914, lxii, 849.
5. Charcot. Sur un cas de Migraine Ophthalmoplegique, Progress Médical, 1890, xii, 31.
6. Idem. Leçons du Mardi, 1879, 78.
7. Cushing. Brain, 1910, xxx, 205.
8. de Schweinitz. Recurrent Abducens Palsy, Philadelphia Polyclinic, vi, No. 34, 343.
9. Féré. Contribution a l'etude de la Migraine Opthalmique, Revue de Méd., 1881, i, 648.
10. Idem. Migraine Ophthalmique Suivis de Mort, Revue de Méd., 1883, iii, 194.
11. Flatau. Die Migraine, Monographie aus dem Gesamtgebiete Der Neur. u. Psych., 1912, H. i, 1-3.
12. Galezowski. Migraine Ophthalmique, Arch. Gén. de Méd., 1878, i, 669, ii, 36.
13. Hunt, Ramsay. The Sensory System of the Facial Nerve and its Symptomatology, Jour. Nerv. and Ment. Dis., 1909, xxxvi, 321.
14. Karplus. Zur Kenntnis der Periodischen III Lähmungen, Wien. klin. Woch., 1895, No. 50 u. 52, viii, S. 883.
15. Luzenberger. Periodische Trochlearis Lähmung, Neur. Centralbl., 1898, xvii, 73.
16. Moebius. Ueber Periodisch Wiederkehrende III Lähmung, Berl. klin. Wochenschr., 1884, No. 38, xxi, S. 604.
17. Omerod and Holmes Spicer. Recurrent Paralysis of Ocular Nerves, British Med. Jour., March 21, 1896, 729.
18. Oppenheim. Migraine Ophthalmoplegique, Lehrbuch Der Nervenkrank, 1913, i, 619.
19. Idem. Migraine, Lehrbuch der Nerven Krank, 1913, ii, 1568.
20. Idem. Beitrag zur Prognose der Hemikranie, Charité Annal., 1888, xv, 298.
21. Paderstein. Ophthalmopl. Migraine, Deutsch. Zeit. f. Nerv. Heil., 1899, xv, 418.
22. Rossolimo. Rezidivirrende Facialis Lähmung Bei-migraine Neur. Centralbl., 1901, 744.
23. Sil. Ophthalmoplegischer Migraine mit einer Hypoglossus Paralyse, Arch. Bohem. de med. Clin., 1907, viii, 357. (Cited in Neur. Centralbl., 1908, xxvii, S. 972.)

24. Shinoya. Migraine Ophthalmoplegique, Deutsch. Zeit. f. Nerv. Heil., 1911, xlii, Heft 1, 155.
25. Thomas, J. J. Migraine and Hemianopsia, Jour. Nerv. and Ment. Dis., 1907, xxxiv, 153.
26. Thomsen-Richter. Neur. Centralbl., 1884, S. 548. Archiv. f. Psych., 1886, xvi.
27. Veasey. Migraine Involving the Abducens Nerve, Ophthalmic Record, August, 1909.
28. Von Schroeder. Ueber Bleibende folge Erscheinungen des Flimmer Scotum, Klin. Monat. bl. f. Augenhk., 1884, xxii, S. 531.
29. Von Infeld. Zur Kenntniss der Bleibende folgen des Migraine Anfalles. Wien. klin. Woch., 1901, xiv, S. 28.
30. Voss. Ueber die Diagnose des Kopfschmerzes, Petersburg. med. Wochschr., 1910, xxvi, S. 9.
31. Weiss. Ein Fall von periodisch Auftretender totaler Linkseitiger III Lahmung, Wien. med. Woch., 1885, No. 17, 522.
32. Williams. Migraine and Hemianopsia, Jour. of Nerv. and Ment. Dis., 1912, xxxix, 187.

THE ROENTGEN-RAY IN GASTRO-INTESTINAL AFFECTIONS.[1]

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In reviewing the literature on roentgenology, one recognizes that for a number of years most of the advancements in this specialty have come from the same contributors. The men who are maintaining high standards of work are few, and as a consequence the physician is often obliged to accept the interpretations of inadequately prepared roentgenologists. The apparent simplicity of this science has caused a number of men to follow it who have not the necessary preliminary training to properly qualify them for their work.

The subject is new, and its literature, particularly in English, is so scant that one who is seeking to perfect himself in this specialty is able to find but few reliable sources of information. The isolated observations and occasional monographs are not always readily accessible. The courses offered for the study of roentgenology in both graduate and undergraduate schools are limited, and the amount of time that can be devoted to the subject by the undergraduate is restricted. The average postgraduate schools do not give the thorough training which is so much to be desired, because the time allotted is too short and the number of cases completely studied far too few.

There is a lack of uniformity in the methods of roentgenological examination followed by specialists of apparently equal standing.

[1] Read before the annual meeting of the American Gastro-enterological Association at Baltimore, Md., May 10, 1915.

To illustrate: there is no standard or test meal for roentgenographical examination of the gastro-intestinal tract. The American, German, and English test meals differ. Such a standard meal is as necessary for roentgenographical examination as the Ewald test breakfast for chemical analyses. A standard test meal would obviate the necessity of always specifying which opaque salt was used.

Physicians without sufficient experience in roentgenology often draw erroneous conclusions, and their patients are frequently subjected to improper treatment because diagnoses are made from incomplete roentgenographical findings, based on too few plates or a hasty fluoroscopical examination. Such inaccurate examinations are allowed to displace the ordinary routine diagnostic methods, and, as a frequent result, the patient is treated medically or surgically for a condition that does not exist.

An accurate knowledge of the pathology that is subject to roentgenological examination is necessary for decisive interpretations. Time and again it has been emphasized that the skilled roentgenologist must be a good clinician, one who is able to correlate the clinical history and the present physical condition of the patient with the laboratory findings. That a roentgenologist should have a thorough training in pathology has not been heretofore emphasized. If one is unable, through insufficient knowledge of pathology, to form an adequate mental picture of the physical changes resulting from disease, he cannot understand the records shown on the Roentgen plate. The Roentgen-ray may be likened to a most powerful microscope, revealing living structures in health and disease. Just as it is necessary to have an accurate knowledge of histology and pathology in order to interpret a cut section of tissue, so it is imperative that our roentgenologists should be grounded in anatomy, physiology, and pathology if they are to make their conclusions valuable and decisive to the consulting physician. Few clinicians have sufficient knowledge of Roentgen pathology to justify them in attempting the full interpretation of a series of plates.

The Roentgen-ray diagnosis of pronounced gastric pathology is comparatively easy. Definite lesions, which are conspicuous at autopsy or operation, are readily recognized. The recognition of an hour-glass stomach, a perforating ulcer of the stomach, or an obstruction of the pylorus is not very difficult. The statement has been made that fully 95 per cent. of patients with so-called stomach symptoms are not really suffering from gastric disease but from some other abdominal disease, as chronic appendicitis or cholecystitis. The roentgenologist should therefore have the special training that is necessary to enable him to discover by the Roentgen-ray the remote lesion that is the cause of the patient's symptoms. These cases of reflex irritation in which the pathological condition may be in the gall-bladder, in the appendix, or in the colon, offer the roent-

genologist his most difficult problem and an opportunity to show his experience and the refinement of his technique.

In order that the limitations and possibilities of Roentgen diagnosis may be established, it is necessary to secure a standardization of methods and technique.

Many cases have been observed which illustrate the need of a universal technique. I will quote one typical case, in which the roentgenologists concerned, leaders in this specialty in different cities, because of variation in technique, reached different conclusions. The point involved was the position of the stomach. One roentgenologist reported that with the patient in the prone position the stomach was drawn upward and to the right of the median line, indicating the so-called "gall-bladder position." The second roentgenologist independently reported as follows:

"It is to be understood that I had no knowledge of the first examinations until my conclusions were complete. If the patient is examined in the upright position, I question whether such roentgenograms as Dr. X. shows could be obtained, as in my whole series with the patient in the upright position, not only by plate but by fluoroscopy, the stomach swings well to the left of the median line and by manipulation is apparently in no way fixed. I have found by experience, whether it be true or not, that a patient studied by the fluoroscope in the prone position, such as Dr. X. refers to in his report, leads to just such conclusions as he has reached. This is due in a great measure to pressure which is to be expected in well-nourished individuals."

The question involved, a matter of position is a simple one, but because of the slight difference in technique the positive diagnosis of one examiner was discredited by the second on the basis that the observations upon which the first diagnosis was made were due to the position of the patient at the time of the examination. It is evident that a definite and uniform plan of procedure in Roentgen-ray work must be adopted if the conclusions of the roentgenologists are to be respected.

We must always remember that the stomach is a flexible, muscular organ, capable of widely different appearance when viewed with slightly varying technique under slightly differing conditions.

Roentgenologists are constantly being asked what machines to buy. A prominent roentgenologist states that he is almost daily in receipt of letters inquiring about the kind of a machine to purchase. More emphasis is often placed upon the choice of a machine than upon the acquirement of the knowledge necessary to enable one to interpret the diagnostic data produced by the machine.

As an example of incorrect diagnoses produced by embryonic roentgenologists, we would cite the following: A physician was induced by a persuasive agent to purchase a powerful Roentgen-ray machine. He took six 14 x 17 plates of six different cases, *i. e.*, one of each case, and advised surgical operation in every case.

This man, on account of his inexperience, did not know the normal roentgenographic appearance of the human gastro-intestinal tract. The six patients underwent operation, and in none of them was any pathological condition found in the abdomen. One of the cases showed a normal stomach with two peristaltic waves present. The portion of the stomach included between these waves was diagnosed as a neoplasm, and operation was advised on the strength of this diagnosis. It seems incredible that a physician without adequate training and experience in roentgenology should assume the responsibility of advising such serious surgical procedure.

A prominent surgeon in a large hospital bought a roentgenographic apparatus and undertook roentgenography. His first case was a typical hour-glass stomach, which showed very well on the single plate taken. The easy diagnosis of this comparatively simple condition greatly encouraged him to continue. Then followed a series of cases, each diagnosed from a single plate. The percentage of errors which necessarily followed was very high.

A few cases will be cited to illustrate and emphasize points previously mentioned. The first is that of a man, aged thirty-eight years, whose chief complaint was loss of weight. The roentgenologist found a slight filling defect in the transverse colon to the right of the median line. Only one examination was made. Operation for carcinoma was advised. At operation the colon was found to be normal. This roentgenologist did not make a sufficient number of plates, and did not know that the filling defect he observed is a normal finding. Since spastic manifestations may be due to various causes, we feel that no surgical intervention should be advised on a single examination.

A patient, aged thirty-five years, whose complaint was indigestion, was carefully examined by an internist, who thought he detected free fluid in the abdominal cavity. An aspiration was done and a few cubic centimeters of bloody serum secured. The patient consulted a surgeon, who, after an examination, decided that the case was one of gastric carcinoma, and desired the opinion of the roentgenologist. The surgeon had been accustomed, just before sending such cases to his roentgenologist, to invariably give them a gastric lavage. The fluoroscopic and roentgenographic examinations showed a pyloric filling defect in all the plates. A diagnosis of carcinoma was made, and agreed to by the internist and surgeon concerned. One month later the roentgenologist saw the man, who had gained in weight and was feeling very well. He realized at once that he had erred in his diagnosis and closely questioned the patient. He discovered that one-half hour previous to his roentgenographic examination the patient had eaten a hearty meal and that he had not received the usual gastric lavage. These facts easily explained the appearance of the filling defect and the consequent error in diagnosis. The man is alive and well today.

We have record of at least ten cases of deformity of the duodenal

cap in which a diagnosis of ulcer was made by roentgenography, surgery advised, and at operation a chronic appendicitis found. Such cases of apparent deformity belonging to the group of "spastic contractions" are prevalent and require diagnostic skill to distinguish them from actual lesions of the pylorus and duodenum.

A series of eight cases in which a diagnosis of gastric or duodenal ulcer was made, based upon a careful Roentgen-ray examination, is most interesting and instructive. At operation no pathology of the stomach or duodenum was found. The appendix was removed in all these cases and the gall-bladder inspected. The patients obtained no relief from their symptoms, and at subsequent operations, performed within one year, definite gastric or duodenal ulcers were found. The surgeon simply explored the peritoneal surface at the first operation and therefore failed to find the lesions demonstrated by the Roentgen-ray. These cases illustrate that the surgeon and clinician should be slow to discredit the diagnosis of the well-trained roentgenologist.

The welfare of the patient is best served by the friendly team work of the internist, surgeon, and roentgenologist. This necessitates a careful review and correlation of the findings of each of these specialties. An antagonistic and hypercritical attitude of the respective physicians concerned often retards the diagnosis.

I am of the opinion that the adoption of certain recommendations will increase the value of the Roentgen-ray as a diagnostic aid in gastroenterology. I do not offer these suggestions in a spirit of criticism, but am prompted by a desire to secure better coöperation between clinicians and roentgenologists. These recommendations are:

1. That the roentgenologist should be a trained and experienced anatomist and pathologist.
2. That there should be standardization of methods and technique.
3. That the physician acquire the ability to properly estimate the diagnostic value of a Roentgen-ray report.
4. That the patient should not be subjected to operation without a confirmation of the original findings by a second Roentgen examination made after an interval of two or three days.
5. That the clinician must not attach too much significance to the Roentgen-ray findings unless they are absolutely decisive.
6. That the lesion discovered by the Roentgen-ray must be a constant finding, regardless of position or slight variations in technique.
7. That great care must be exercised to differentiate physiological and spastic conditions from those that are essentially pathological.
8. That the Roentgen-ray report should be considered on the same basis as any laboratory report.
9. That the physician must carefully correlate the Roentgen-ray findings with the anamnesis and the clinical and laboratory findings.

THE LATE RESULTS OF CARDIORRHAPHY: REPORT OF CASE THREE YEARS AFTER OPERATION.

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Although the immediate results of cardiorrhaphy have been brilliant, as is attested by the fact that approximately 50 per cent. of patients have recovered after operation, according to the statistics of E. Hesse, Müller, Wagner, and others, a feeling of uncertainty must exist as to the ultimate condition of these patients. The question naturally arises as to whether an individual whose heart has been wounded, subsequently exposed by operation, handled and sutured, can return to the same condition of health as before. It is important for the future of cardiac surgery that the effects of such traumatism upon the action of the heart and upon the health and working capacity of the patient should be determined. With this in view we report the late results of a case of cardiorrhaphy operated upon by one of us three years ago, and likewise present the late results of similar cases in so far as these could be ascertained.

Case Report. On July 18, 1911, a young man, aged twenty-four years, was brought to the New York Hospital about thirty minutes after he had stabbed himself with a knife. The patient was in a condition of profound shock. There was a wound about one-half inch in length in the fourth intercostal space close to the upper border of the fifth rib and just mesial to the nipple. From the symptoms and physical signs it seemed reasonably certain that there was a wound of the heart. Accordingly operation was undertaken without delay. The following description of the operation and post-operative course is taken from the *Annals of Surgery*, 1912, lv, 485:

"The wound was extended along the upper border of the fifth rib toward the sternum, crossing and dividing the cartilage near its insertion. The stab wound entered the pleura, and in exposing the pericardium the pleura was injured further. The pericardium was incised in the direction of the wound, allowing the escape of considerable blood, and the index finger was inserted into the pericardial sac. It failed to locate the wound in the heart, but palpation of the inner surface of the pericardium revealed an opening in it, corresponding in position to the original surface wound. The exposure of the heart was rapidly improved by making a 'trap door.' For this the incision was carried upward along the sternum and thence outward along the lower margin of the third costal cartilage. The cartilages of the third and fourth ribs were divided close to the sternum, the third being readily exposed by retracting the soft parts upward. The two cartilages were then carefully lifted, sep-

arated from the pleura, and fractured at the costochondral junction, forming a flap with skin and muscles attached; resection of the fifth cartilage was contemplated but was delayed and did not prove necessary. The internal mammary was clamped and ligated above and below when exposed. The opening in the pericardium was enlarged by an incision upward near the sternum, making a triangular flap. Hemorrhage was very free.

Palpation revealed the rent in the heart, which admitted the tip of the index finger. As the finger was withdrawn from the hole a well-vaselined silk suture was passed from above downward on a fine curved intestinal needle; this was tied and left long. By gentle traction on this suture the heart was readily lifted and rotated, so that the wound was rendered visible and readily accessible. The wound involved the left margin of the heart somewhat posteriorly; it was about one-half inch in length, transverse on the long axis of the heart, and approximately one and one-half inches above the apex. Though the wound was partially closed by the first suture, blood gushed out whenever the finger was momentarily lifted to pass a stitch. Five stitches were inserted and tied before the bleeding was completely controlled. All visible blood was then removed and the pericardium closed with interrupted catgut stitches. There was considerable tension between the edges of the pericardial wound, which caused some gaping between the stitches in the lower mesial part. The flap was replaced and chromic stitches used to repair muscles and fascia. The skin was closed with silk. In the outer angles of the wound rubber tissue drains were inserted through the skin. At the lower mesial angle of the wound a rubber tissue drain was inserted down to but not into the pericardium. After the wound in the heart had been closed an infusion of 16 ounces of salt solution was given. The operation took about thirty minutes.

Post-operative Course. For twenty-four hours after the operation the patient was restless, irritable, and thirsty. He was given morphin freely and saline continuously by rectum (Murphy drip). During this time the highest pulse rate was 128; respirations were 24 to 28; temperature, 102°. When the dressing was changed at the end of sixteen hours and the drains removed, a very large quantity of clear serum exuded from the drainage openings. A rubber tissue drain was therefore reinserted at the lower inner angle. A similar discharge occurred again at the next dressing thirty hours after the operation. At that time the pulse had risen to 132; the temperature remained 102°. White blood cells were 19,000, polymorphonuclears, 83 per cent. The serous discharge continued to be free until forty-eight hours after the operation, when the single remaining drain was removed from the lower and inner angle of the wound. At this time the pulse was 112, temperature 101°, respirations 24. The patient was refractory and refused

to eat, because, he said, he wanted to die; he was also very irritable and restless. Twice he sat up in bed. Morphin was given and he became quiet. Rectal alimentation was begun.

July 22 (fourth day). Condition good, pulse 104 to 124, temperature 102°. White blood cells 17,500, polymorphonuclears 84 per cent. Patient still refused nourishment. Wound dry and clean.

July 23. Condition about the same.

July 24 (sixth day). Large amount of serum exuded from the wound, after which the pulse became very rapid.

July 25 (seventh day). Constant free discharge of clear serous fluid requiring frequent dressings. The patient still refused nourishment, was extremely weak, and appeared to be in serious condition."

The systolic blood-pressure, taken twice a day from the third to the eighth day, was always between 90 and 110.

July 26 (eighth day). The patient was persuaded to eat by threats of passing a stomach tube; nutrient enemata were discontinued. Wound dry and clean, temperature normal, pulse 90, white blood cells 10,000, polymorphonuclears 74 per cent. From this time the convalescence was uneventful. He was allowed up on the eighteenth day and discharged from the hospital on the twenty-fifth day."

The man was imprisoned for two and a half years after leaving the hospital and followed the routine prison life without inconvenience; for the last six months he has led an active life.

On August 16, 1914, he reported for examination. He stated that on exertion he often experiences a dull pain in the region of the heart which lasts for a few minutes. Since the operation, he has had slight shortness of breath on walking fast or climbing stairs rapidly. Otherwise, his health and strength have been normal.

Physical Examination. The patient is well developed; of medium height; weighs 131 pounds (at time of injury, 129 pounds).

Chest: Size and shape normal. A large scar is present over the precordial area. The scar consists of three limbs. The upper transverse limb, measuring 4 cm., corresponds to the third intercostal space; the lower, 7 cm. long, corresponds to the fifth interspace. The vertical limb is close to the left border of the sternum. Respiratory movements are normal.

There is a systolic impulse diffused over an area about 4 cm. in diameter and with its maximum intensity about the centre of this area at a point 8 cm. to the left of the midline in the fifth interspace. A slight diastolic retraction can also be seen over this area.

Tactile fremitus is normal over entire chest. The cardiac impulse is felt with maximum intensity in the fifth interspace 8 cm. to the left of the middle line with patient in upright position; with patient lying on the right side it is felt 6.5 cm. from the midline, and with patient lying on the left side 11 cm. from the midline. No thrill felt.

Pulmonary resonance is normal over the entire chest. The right border of the heart percusses 1 cm. to the right of the right border of the sternum; the left border percusses 11 cm. to the left of the midline.

Respiratory sounds are normal over entire chest. No adventitious sounds are present. The first heart sound is heard with maximum intensity in the fifth interspace 8 cm. to the left of the midline. A soft blowing systolic murmur is heard with maximum intensity in the fifth interspace 8 cm. to the left of the midline and

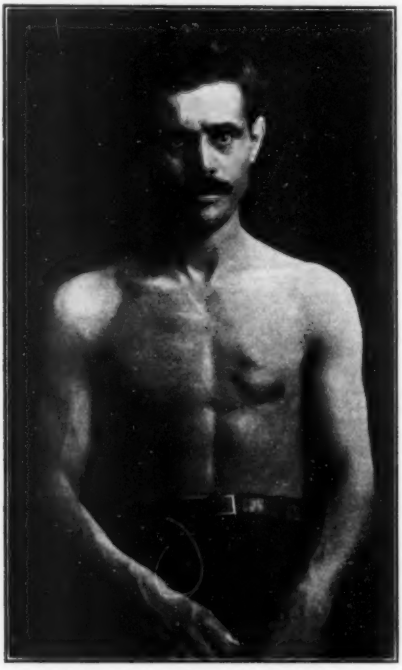

FIG. 1

is transmitted for about 4 cm. to the left and 2 cm. to the right of the point of maximum intensity. No other murmurs heard. No friction rubs present. Muscular quality of heart sounds is good. The pulmonic second sound is slightly accentuated.

Pulse: The pulse was 70, regular in force, volume, and rate. The blood-pressure while at rest is: left arm, 110 systolic, 60 diastolic; right arm, 112 systolic, 60 diastolic.

After active exercise with chest weights for five minutes the pulse rate is increased to 75 beats per minute, the blood-pressure

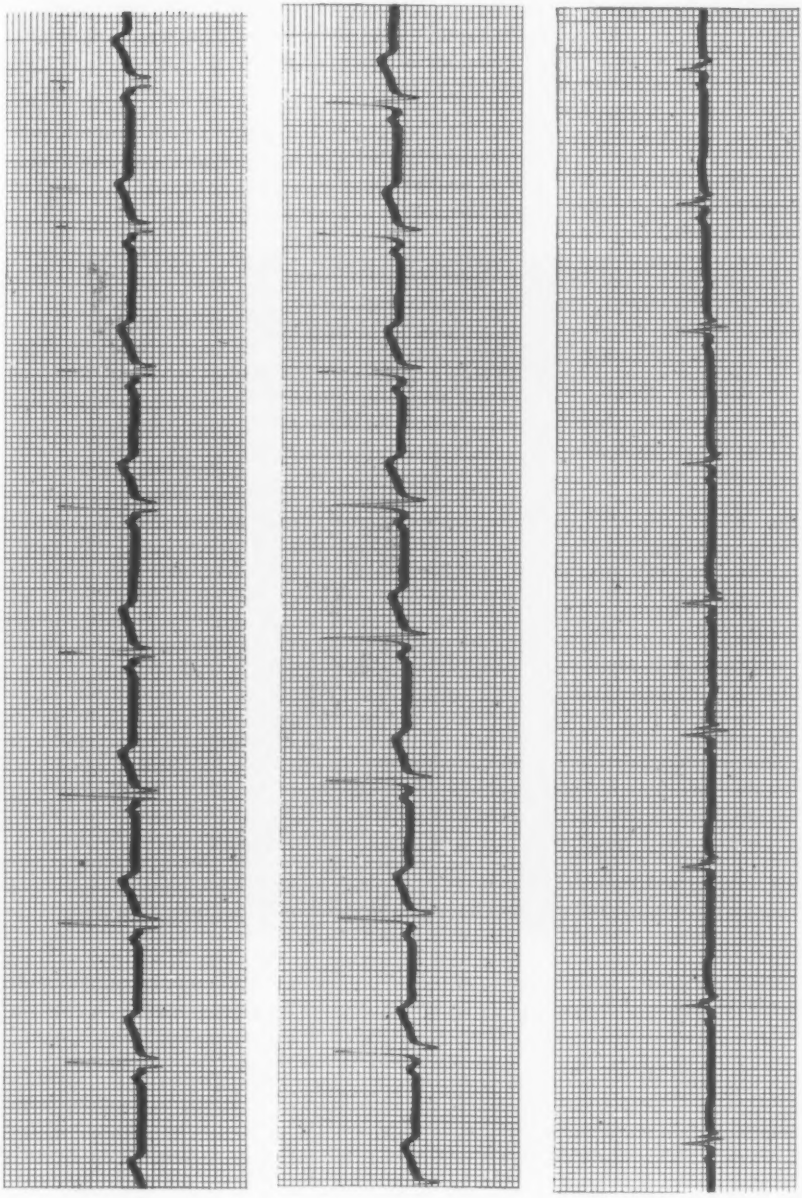

FIG. 2.—Upper curve from lead I, middle from lead II, and lower from lead III. Abscissa, 1 div. = 0.04 sec. Ordinate, 1 div. = 10.4 volt.

remaining the same; left arm 112 systolic, 60 diastolic; right arm, 112 systolic, 60 diastolic. After resting for five minutes the pulse rate is 70 per minute and the blood-pressure; 110 systolic, 60 diastolic in both arms.

The heart work (Sahli sphygmobolometer) is: 11.2 gm. cm. of Hg. left arm; 12.4 gm. cm. of Hg. right arm.

No abnormal venous or arterial pulsations visible; no visible capillary pulsations; no cyanosis, edema, nor pallor. The physical examination presents nothing further that is worthy of note.

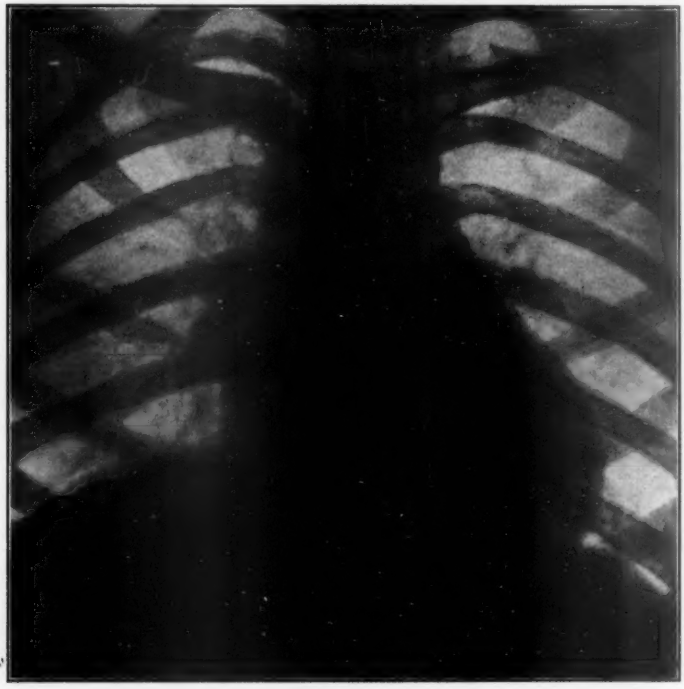

FIG. 3

An electrocardiogram (Fig. 2) (Dr. Horatio Williams) shows a normal curve with the exception of a slight retardation in the conduction time, which probably is not dependent upon the injury to the heart.

Simultaneous tracings taken at the apex, carotid, and jugular show normal curves. (MacKenzie polygraph).

Roentgen-ray examination (Fig. 3).

Dr. A. H. Busby: The heart appears to be normal in size, shape, and situation; it extends one inch to the right of the right margin

of the sternum and three inches to the left of the left margin of the sternum, the widest horizontal measurement of the heart being five and three-quarter inches. There is no niche or indentation breaking the outline, and there is no suggestion of adhesion or distortion. The outline of the heart in the supine position is very clear. Enlarged lymph nodes are seen at the hilus of the lung and also about some of the larger bronchial ramifications.

The Late Results in Published Cases of Successful Cardiorrhaphy. An attempt has been made to ascertain and record the late results in the reported cases of recovery after heart suture. The facts about some of these cases were obtained through personal communications as a result of letters which were sent in January, 1913, to those surgeons who had reported successful cardiorrhaphies prior to 1912. The replies were relatively few and consequently the collection of ultimate results is not as complete or enlightening as could be desired.

Parlavecchio: Operation 1898. Male, aged twenty years. Stab wound in fifth left space. Eight hours between receipt of wound and operation. Resection of fifth rib. Wound in left ventricle near apex 3.5 cm. in length. Four silk sutures. No drainage of pleura or pericardium; no complications. Recovery.

The patient was seen in 1913, fifteen years after operation. His general condition was excellent. He is in the flower business and can work well. Local examination shows nothing abnormal except a systolic retraction at the cicatrix. (Personal communication.)

Launay: Operation, 1901. Pistol-shot wound at left nipple. Male, aged twenty-six years. Extreme hemothorax. Lung wounded. Four hours between receipt of wound and operation. Flap of fourth, fifth, and sixth ribs, hinge external, pleura freely opened. Left ventricle, two wounds; entrance wound near apex, exit wound near base. Both wounds closed with catgut sutures. Drainage of pericardium and pleura. Recovery.

The patient enjoyed good health for about two years, when he died of typhoid fever. The autopsy findings presented by Launay were as follows: There was almost complete adherence of the pericardium. Two soft depressions were present on the left ventricle; the anterior, where the bullet entered, was situated near the left margin 4 cm. from the apex; the posterior, was below the auriculoventricular groove near the left margin.

After opening the left ventricle there was visible on the anterior wall a white cicatricial zone on a level with the insertion of the anterior mitral pillar.

On the posterior wall of the left ventricle near the interventricular septum there was a cicatrix 2.5 cm. long. Its general form was oval, the lower extremity being larger. At that place the projections of the columnæ carnea were modified and the cicatrix slightly depressed.

Launay stated that no weak points could be recognized in the cicatrix, and that the obliquity of the parietal wounds explained the fact that in the operation hemorrhage stopped during systole.

Riche: Operation 1902. Female, aged thirty years. Stab wound in the fourth left space, parasternal line. Operation two hours after injury. Flap of third and fourth ribs, hinge external. Pleura freely opened. Wound 5 mm. in right ventricle, sutured, no drainage, no complications.

The patient was a delicate woman who did little work prior to the operation. She had a child in December, 1903, and another in July, 1905. Riche examined her on February 4, 1907, five years after operation. She had a pseudarthrosis of two costal cartilages. The heart was a little more vertical than normal. When the patient was made to lie on the right side and on the left side the heart became less displaced than normal, suggesting that there were some adhesions between the surfaces of the pericardium. The apex beat was near the sternum, in contact with the seventh cartilage. No abnormal sounds; function normal. The patient was as strong as before her attempted suicide. (Personal communication.)

Manteuffel (1903): Female, aged twenty-one years. Gunshot wound, fourth interspace. Operation about nine hours after the injury. Longitudinal incision at left sternal margin; resection of fourth, fifth, sixth, and seventh costal cartilages; removal of a strip of sternum 2 cm. in width. Entrance orifice, 5 cm. from apex, in right ventricle. Silk suture. Bullet in posterior wall of right ventricle; extraction, suture. Pericardium was closed with four sutures. No drainage of pericardium; pleura drained. Serous pericarditis followed; aspiration; the patient finally made a good recovery.

Patient was married in 1906; has two children. She was presented in 1905 before the Surgical Congress in St. Petersburg.

Was seen in 1914, eleven years after operation. Cicatrix slightly retracted; participates in pulsation. Limits of cardiac dulness and heart sounds normal. No functional disturbance of any kind.

In roentgenograph, the shadow on the right side projects beyond the sternal margin, and the angle at the left auricle is obliterated. At the base of the heart are seen peculiar feather-like shadows, which are perhaps to be interpreted as adhesions. The position of the heart is somewhat more horizontal than normal. (Personal communication.)

Borchardt: Operation, 1904. Male, aged twelve years. Impaled on picket fence. Hemopneumothorax. Two and a half hours between receipt of wound and operation. Incision from sternum to axilla; resection of sixth cartilage and rib. Left ventricle presented a wound 1.5 cm. long on posterior wall. Four silk sutures. Drainage of pericardium and pleura. Recovery.

The patient was last seen in 1911, seven years after operation. He was then in excellent health and capable of any work. (Personal communication.)

Sultan: Operation, 1907. Male, aged thirty-eight years. Pistol-shot wound in fifth left space just inside nipple line. Thirty hours between receipt of wound and operation. Flap of fourth and fifth left cartilages and part of sternum; hinge mesial. Pleura not opened. Hemopericardium, 200 c.c. Non-penetrating wound in posterior surface of left ventricle, 1.5 cm. long. Three silk sutures. No complications. Recovery.

The patient was last heard from in 1912, five years after operation. His health was excellent, and he was able to do his work as carpenter, which necessitated extreme exertion and heavy labor. The last examination was in 1910, three years after operation, when no deviations from the normal could be demonstrated. (Personal communication.)

Blake: Operation, December 13, 1907. Male, aged twenty-four years; colored. Stab wound through fourth left cartilage, 1 cm. within nipple line. Two and a half hours between receipt of wound and operation. Flap of third, fourth, and fifth cartilages; hinge internal. Pleura freely opened. Left pleura contained two pints of blood; pericardium about two ounces. Wound in right ventricle. Three interrupted silk sutures; one superimposed mattress suture. No drainage of pericardium or pleura. Gauze drain in stab wound. Double pneumonia; left empyema, drained on twenty-sixth day after operation. Wound infection. Recovery.

The patient was seen for the last time in March, 1907, when he was in good condition, heart action regular; pericardial friction sound. (Personal communication.)

Peck: Operation, 1908. Female, colored, aged twenty-three years, stab wound through third left cartilage at the border of the sternum. Flap of third, fourth, and fifth ribs; hinge external. Resection of part of the sternum. Pleura not opened. A wound, 1 cm., was found in right auricle. Four chromicized catgut sutures inserted. No drainage of pericardium. Recovery.

Patient died in the City Hospital of pulmonary tuberculosis. Autopsy showed extensive pulmonary miliary tuberculosis. Pericardium greatly thickened, with tubercles in fibrous coat; complete obliteration of pericardial sac, visceral and parietal layers being adherent throughout. Site of heart wound could not be identified; heart walls somewhat thinned, as commonly seen in adhesive pericarditis, otherwise normal. It was thought that the adhesive process was due to tuberculous pericarditis rather than to the effects of the trauma and operation. (Personal communication.)

Proust: Operation, 1910. Male, aged thirteen years. Gunshot wound mesial to the left nipple; fifth costal cartilage fractured by bullet. Time between injury and operation six hours. Exposure by osteoplastic flap following division of fourth to sixth cartilages near sternum. Pleura opened. Tangential wound of left ventricle near apex. Four deep sutures covered by superficial sutures.

Small rubber drainage tube into pericardium. Suture of the pericardium with interrupted catgut. High temperature and signs of pericardial effusion in second week. The patient also had some difficulty in swallowing. Little discharge; the drainage tube was removed and a large amount of bloody fluid escaped; improvement; temperature normal in less than forty-eight hours. Patient discharged well one month after operation.

Subsequent report of case from paper read before American Surgical Association, 1914.

Immediately after his discharge from the hospital the patient was engaged as messenger boy. He followed this occupation for three years and did not experience any trouble except at first, when he noticed some shortness of breath after hurrying up stairs. For the last year he has been employed as bookkeeper and complains of no trouble.

Auscultation and the electrocardiogram showed that the action of the heart was almost normal. The apex seemed a little too near the sternum and the electrocardiogram showed a double bracket at the time of the ventricular contraction. Radioscopic examination showed very slight modifications:

At the union of the external two-thirds and the internal third of the left border is seen a permanent notch, which seems to be a fixed point, and does not participate in the beating of the left border, as if at this level there were something restraining this margin. Moreover, below this notch is seen on the left ventricle itself a circular zone three-fourths of an inch in diameter, which is relatively clear in contrast to the deep color of the remainder of the ventricle. Proust explains the notch as due to adhesions and the clear zone as an abnormally thin condition of the myocardium following a scar.

A Roentgen-ray examination following the ingestion of bismuth showed a diminution in the diameter of the esophagus from the site of the large vessels to the diaphragm.

F. Hesse (1909): Stab wound, 1 cm. in length, in third left intercostal space, four fingers' breadth from sternum. Male, aged thirty-five years. Time between injury and operation nearly three hours. Wound in left auricle 0.75 cm. long. Resection of ribs and cartilages, also a strip of sternum. Pleura opened. Three silk sutures. Large rubber drainage tube into pericardium. Two drainage tubes into pleural cavity in scapular line by resection of rib. Discharge from pleural cavity profuse, from pericardial cavity slight, so that drain was removed on fifth day. Pleural drain left for a month. Recovery.

Examination of patient on discharge showed a small granulating area, otherwise a normal scar. Lower border of left lung is one to one and a half fingers' breadth higher than the right. Lungs otherwise normal.

Cardiac boundaries normal. Sounds loud and clear. No pericardial friction sounds. Pulse regular and equal but slightly accelerated. Patient feels a sense of oppression in region of heart on slight exertion.

Examination of patient two years after discharge: slight systolic retraction in fifth interspace mesial to midclavicular line. Heart sounds clear but diminished in intensity. Pulse 80 to 90. After exercise slight arrhythmia.

F. Hesse (1909): Stab wound 1 cm. long in third left intercostal space near sternum. Male, aged twenty-four years. Pronounced heart tamponade. Time between injury and operation, two and a half hours. Left auricle, 0.75 cm. Flap with external pedicle of third and fourth cartilages and part of ribs; resection of half of adjacent sternum; section of fifth rib. Pleura opened. Three silk sutures. No drainage. Recovery.

Examination of patient two years after discharge: Patient says his hands frequently become blue and cold; and that he sometimes feels a sharp pain in the chest especially after exertion. The precordium is markedly flattened and there is a distinct systolic retraction in the fifth interspace for a distance of 4 cm. inside of the midclavicular line. Right border extends to midsternal line at level of third rib. Heart sounds are slightly roughened at the apex; at the base they are clear but diminished in intensity. Pulse is full, regular, and equal.

F. Hesse (1909): Stab wound, 2.5 cm. long, under left nipple, in fourth intercostal space. Male, aged seventeen years. Hemopneumothorax. Time between injury and operation three hours. Wound in left ventricle a little below the atrioventricular boundary. Resection of fourth rib from nipple to sternum; pleura opened. Five silk sutures. Removal of clots from pleural cavity. No drainage. Pleurisy and pneumonia. Entire wound opened and healed gradually. Recovery.

Examination of patient in April, 1911, two years after operation: Patient has resumed his work as porter and says that he experiences no discomfort either during rest or exertion. The sternal end of the scar is markedly depressed, enough to admit two fingers into the depression. Over this region the skin is red and tender and united with the pericardium. Heart impulses are readily felt in this area. Cardiac boundaries extend from midsternal line to 1 cm. outside of left nipple, which has moved 1 cm. inward and 1 cm. upward. Heart sounds are regular.

E. Hesse (1905): Stab wound, 3 cm. long, parasternal line, fifth intercostal space. Male, aged nineteen years. Heart tamponade. Time between injury and operation one hour. Penetrating wound of right ventricle. Incision along left sternal margin and fifth rib; resection of sternal segments of fourth, fifth, sixth, and seventh ribs. Three sutures. Drainage of pericardium. Drainage

of pleura through wound. Change of dressings on fifth day; tampons soaked. Recovery.

Examination of patient on discharge from the hospital: Wound healed. Percussion of heart shows a lengthening of horizontal measurements; vertical measurements normal. Heart sounds are clear and distinct. Pulse is 90. Rhythm normal. Blood-pressure 80. Lungs normal. No dyspnea on exercise.

Five years after the operation the patient wrote saying that he was perfectly well and doing his regular work.

E. Hesse (1908): Stab wound, 2 cm. long, between fourth and fifth costal cartilages, one and one-half fingers' breadth to left of sternum. Male, aged twenty-one years. Stab wound of abdomen, viscera uninjured. Time between injury and operation an hour and a half. Wound in right ventricle, 1 cm. Skin-muscle flap, resection of cartilages of fifth and sixth ribs. Two deep sutures. Pericardium and pleura closed. No drainage. Pneumonia on fifth day. Empyema, thoracotomy on eighth day. Obstinate septic diarrhea on twelfth day. Dry pericarditis on fifteenth day. Improvement began fifth week. Discharged, in good condition, in eleven weeks.

Examination on discharge from hospital: Patient in good condition. No dyspnea or dizziness. Pulse strong and accelerated. Heart sounds clear.

Two years and seven months after the operation patient wrote that he was well and working.

E. Hesse (1909): Gunshot wound between fourth and fifth ribs, two fingers' breadth to right of nipple. Exit orifice about four fingers breadth below left scapular angle. Male, aged seventeen years. Time between injury and operation an hour and a half. Resection of fourth and fifth ribs with cartilages, about 7 cm. Wound of left lung. Wound of left ventricle. Three sutures in heart. Suture of pulmonary wound. No drainage. Empyema (left); thoracotomy. Pericarditis sicca. Dry pleurisy on right side. Recovery.

Examination on discharge from hospital: Wound healed. Cardiac area and sounds normal. In the apex of the lung there were some signs of beginning tuberculosis.

Examination in October, 1910: There is a sinking in of the chest between the sternum and the left mammary line over the third, fourth, and fifth ribs; systolic retraction over this area, especially over the fifth rib. Heart and lungs normal except for a diminished vesicular murmur and impaired resonance in left lower lobe of lung. Cardiac border extends to two fingers' breadth mesial to left mammary line and on the right does not extend beyond right sternal border. Heart sounds are clear. Aortic sounds are louder than the pulmonic. Pulse is accelerated (112) but rhythmic. Liver not palpable. No edema. An orthodiagram shows heart bound-

aries distinct. Diaphragm is movable on right side but not on left side where it shows adhesions. The blood-pressure was 110 systolic, 70 diastolic.

The patient says that while resting he feels perfectly well, but that on suddenly changing his position or during emotional periods he suffers from palpitation of the heart.

In April, 1911 (two years after operation), patient writes that he is well and has no untoward symptoms.

E. Hesse (1909): Stab wound, 2 cm. above and to right of left nipple. Male, aged twenty-eight years. Injury of branches of coronary artery. Time between injury and operation four hours. Wound of left ventricle, anterior surface near apex, 1 cm. Resection of fourth rib. Two sutures. Suture of pericardium and pleura. No drainage. Recovery.

Examination of patient one and a half years after operation: There is a slight systolic retraction of the scar. Heart boundaries and sounds good. The diaphragm is freely movable on right side but is adherent on the left. Blood-pressure is normal. Pulse 90 and good quality. Orthodiagram: Heart boundaries distinct and normal. On right side the diaphragm is 6 cm. deeper than on left. Shadows show adhesions on left side. The patient is in good condition and does not complain of any symptoms after hard work.

E. Hesse (1910): Stab wound, about 1.5 cm. long, between fifth and sixth ribs, left side, between nipple and anterior axillary line. Male, aged twenty-seven years. Time between injury and operation one and three-quarter hours. Wound of left ventricle, 2 cm. long, about 5 cm. from cardiac apex. Resection of fourth and fifth ribs, to extent of 6 to 7 cm. from sternum. Three sutures. Suture of pericardium and pleura. No drainage. Left-sided pneumonia on fourteenth day.

Examination of patient twenty-five days after operation showed an absence of pericardial friction sounds and normal cardiac sounds.

Examination eight months after operation: Scar smooth; presystolic but no systolic retraction of the scar. Cardiac outline. Above: to the third rib; left: just mesial to mammary line; right: not beyond right sternal border. Heart sounds are clear. Second pulmonic sound is louder than aortic. Pulse 90 and of good quality. Blood-pressure 115 systolic; 75 diastolic. No venous pulse present. An orthodiagram shows sharp outline of heart except at apex, where there probably are some adhesions. No cardiac enlargement present. No dyspnea. Patient can exercise without disturbance.

E. Hesse (1903): Stab wound, 1.5 cm. long, in second intercostal space, about 2.5 fingers breadth from left sternal margin. Female, aged twenty-five years. Time between injury and operation three hours. Wound of left ventricle, 0.5 cm. Skin-muscle flap, resection of third and fourth cartilages. One suture. Pericardium and pleura sutured. No drainage. Recovery.

Surgeon.	Age.	Sex.	Cause of wound.	Site of superficial wound.	Time between accident and operation.	Site of heart wound.	Postoperative complications.	Material of suture used in heart wound.	Drainage of pleura.	Drainage of [into] pericardium.	Time of last examination after operation.	Condition at time of last examination.
Blake	24	M.	Stab	4th space, 1 cm. inside of nipple line	2½ hrs.	Right ventricle	Double pneumonia and empyemia and wound infection	Silk	No	Secondary	March, 1907, 3 months	Pericardial friction sounds present. Patient in good health.
Borchardt	12	M.	Fell on picket fence	5th space midmammary line	2½ hrs.	Left ventricle, along posterior border	Pericarditis, bilateral pleurisy and bronchopneumonia	Silk	Yes	Yes	7 years	Patient in excellent health and capable of any work.
Launay	26	M.	Gunshot	Left nipple	4 hrs.	Left ventricle, 2 wounds; entrance near apex, exit near base	None	Catgut	Yes	Yes	2 years; patient died of typhoid; autopsy	Autopsy 2 years later; death due to typhoid; marked pericardial adhesione; no weak points in cicatrix; good health for two years.
Manteuffel	21	F.	Gunshot	4th left interspace	9 hrs.	Entrance wound; right ventricle 6 cm. from apex; bullet in posterior wall	Serous pericarditis (aspirated)	Silk	Yes	No	11 years	Slight retraction of cicatrix; few pericardial adhesions at base of heart; health perfect.
Parlavecchio	20	M.	Stab	5th left interspace	8 hrs.	Left ventricle near apex	None	Silk	No	No	15 years	Examination negative except for systolic retraction at cicatrix.
Peck	23	F.	Stab	3d left cartilage at border of sternum	45 min.	Right auricle	Slight pleurisy	Chromic gut	No	No	.....	Autopsy; death due to pulmonary tuberculosis; extensive pulmonary miliary tuberculosis; pericardal sac obliterated; many tubercles in pericardium; site of heart wound could not be identified.
Pool	24	M.	Stab	4th space close to border of 5th rib just inside nipple	50 min.	Left ventricle at left margin of heart	None	Vaselined silk	No	No	3 years	Good health; capable of doing hard work.
Proust	13	M.	Gunshot	5th costal cartilage mesial to left nipple	6 hrs.	Left ventricle near apex	High temperature and signs of pericarditis and effusion in 2d week	Catgut	No	Yes	4 years	Pericardial adhesions; general condition good.
Riche	30	F.	Stab	4th left space parasternal line	2 hrs.	Right ventricle	Dyspnea and attack of suffocation	Catgut	No	No	5 years	Pseudo-arthrosis of two costal cartilages. Adhesions of pericardium; general condition as good as before operation.

Sultan	38	M.	Gunshot	5th left space just inside nipple line	30 hrs.	Non-penetrating wound posterior surface left ventricle	None	Silk	No	No	3 years	Patient in good health and capable of doing heavy work.
F. Hesse	35	M.	Stab	3d left interspace 4 fingers' breadth from sternum	3 hrs.	Left auricle	Profuse discharge from pleural cavity, slight from pericardium	Silk	Yes	Yes	2 years	Systolic retraction in 5th interspace; mesial to mid-clavicular line; slight arrhythmia after exercise; health good.
F. Hesse	24	M.	Stab	3d left space near sternum	2½ hrs.	Left auricle	.....	Silk	No	No	2 years	Systolic retraction in 5th interspace 4 cm. inside mid-clavicular line; heart sounds roughened at apex.
F. Hesse	17	M.	Stab	4th space under left nipple	3 hrs.	Left auricle, little below atrioventricle boundary	Pleurisy and pneumonia	Silk	No	No	2 years	Marked depression of scar; patient in good condition and capable of doing heavy work.
E. Hesse	19	M.	Stab	5th space parasternal line	1 hr.	Right ventricle	.....	.....	Yes	Yes	5 years	Patient in perfect health; examination negative; perfect health; does hard work
E. Hesse	21	M.	Stab	Between 4th and 5th cartilage, 1½ in. to right of nipple	1½ hrs.	Right ventricle	Pneumonia, empyemia, septic diarrhea	.....	No	No	2 yrs. 7 mos.	Patient in perfect health and doing his regular work.
E. Hesse	17	M.	Gunshot	Between 4th and 5th ribs, 1½ in. to right of nipple	1½ hrs.	Left ventricle	Empyemia (left); dry pleurisy (right)	.....	No	No	1 year	Systolic retraction over sunken area between sternum and left mammary line, 3d, 4th and 5th ribs; well and experiences no discomfort.
E. Hesse	28	M.	Stab	2 cm. above and to right of left nipple	4 hrs.	Left ventricle; anterior surface near apex; injury to branches of coronary artery	.....	.....	No	No	1½ years	Systolic retraction of scar; adhesions on left side; good condition and does not complain of any distress afterhard work.
E. Hesse	27	M.	Stab	Between 5th and 6th ribs; between left nipple and anterior axillary line	1½ hrs.	Left ventricles 5 cm. from apex	Pneumonia	.....	No	No	8 months	Presystolic retraction of scar; can exercise without disturbance.
E. Hesse	25	F.	Stab	2d space, 1½ in. from sternal margin	3 hrs.	Left ventricle	.....	.....	No	No	7 years	Slight enlargement of heart toward the right; heart sounds distant, clear, and rhythmic; no subjective symptoms.
Grisogono	18	M.	Stab	3d space, 2½ in. from mammary line	¾ hr.	Left auricle	Pneumothorax	Silk	Yes	No	1 year	Patient practically normal.
Foederl	25	M.	2 stab wounds	One above 4th rib; other below 4th rib	.....	Left ventricle	.....	.....	No	Yes	7 years	Patient well.

SUMMARY.

Number of cases	21
Age—Between 20 and 30 years	13
Between 12 and 20 years	6
Between 30 and 38 years	2
Sex—Males	17
Females	4
Cause of wound—Stab	15
Gunshot	5
Other cause	1
Site of superficial wound—Fourth to fifth left space	15
Above fourth space	6
Time between accident and operation—One-half to one hour	4
One to two hours	4
Two to three hours	6
Three to four hours	2
More than four hours	4
Site of heart wound—Right auricle	1
Left auricle	4
Right ventricle	5
Left ventricle	11
Post-operative complications—Pneumonia	5
Empyema	3
Pericarditis (serous)	4
Pleurisy (non-purulent)	5
Pneumothorax	1
Marked dyspnea	1
None	9
Material used in suture of heart wound—Silk	10
Catgut	3
Chromic	1
Not mentioned	7
Drainage of pleura—Yes	6
No	15
Drainage of pericardium—Yes	6
No	15

Examination three weeks after operation: Heart normal. Pulse shows great oscillations, due probably to an increased irritability of the cardiac nerves.

Examination ten and a half months after operation: There is a systolic retraction of the scar. Heart sounds are regular, dull but clear. Pulse is dicrotic (96) and regular. No subjective symptoms present.

Examination seven years after operation: Patient was admitted for pneumonia. No cardiac symptoms present. There was a slight enlargement of the heart towards the right; the upper boundary extended to lower border of third rib; left border extended to one finger's breadth medial to nipple line. Heart sounds distinct and clear. Pulse rhythmic and good quality. Slight systolic retraction of scar present.

Foederl (1903): Two stab wounds, one above and the other below the fourth rib. Male, aged twenty-five years. Symptoms of progressive hemopericardium. Pleura intact. Wound of left ventricle, 1 cm. Flap of third and fourth cartilages, without injury to the

pleura. Two sutures. Drainage of pericardium with gauze. Protracted course; thoracotomy. Recovery. Patient well at time of report, seven years after operation.

Grisogono: Stab wound in third intercostal space, three fingers' breadth from mammary line, 1.5 cm. in length. Male, aged eighteen years. Pneumothorax; hemopericardium without signs. Time between injury and operation forty-five minutes. Wound 1.5 cm. long, left auricle. Triangular skin-muscle flap. Resection of third and fourth cartilages for 7 cm. from sternum and 5 cm. of second. Four silk sutures. Pleural cavity drained with gauze through lower angle of wound. Pericardium, no drainage. Pneumothorax. Slow recovery; discharged well two and a half months after operation. A year later practically normal.

The table on pages 348 and 349 presents for comparison the important features of these cases. Few deductions can be drawn from these statistics, since they are compounded from an extremely limited number of cases. However, it is striking that in all cases of which we have records a long period after operation, the general condition of the patients was apparently normal. The patients were able to perform arduous work without discomfort, and for the most part without experiencing any subjective symptoms. It is noteworthy that in these cases suppurative pericarditis did not occur as a postoperative complication.

REFERENCES.

Blake. Annals of Surgery, 1908, xlviii, 138.
Borchardt. Sammlung. klin. Vorträge, Leipzig, 1906, N. f. Chir., 113–114.
Foederl. Wien. klin. Woch., 1910, xxiii, 923.
Grisogono. Wien. klin. Woch., 1910, No. 25, 924.
E. Hesse. Beitr. z. klin. Chir., 1911, lxxv, Heft 3, 475.
F. Hesse. Archiv. f. klin. Chir., 1911, xcv, Heft 4.
Launay. Bull. de l'Acad. de méd. de Paris, 1902, xlviii, 185; Bull. et mém. Soc. de chir. de Paris, 1904, xxx, 896.
Manteuffel. Centralb. f. Chir., 1905, xxxii, 1096.
T. Müller. Münch. med. Woch., Berlin, 1914, lxi, No. 30, p. 1657–1712.
Parlavecchio. Lo Stato del. Chirurgia del Cuore, Monograph, Rome, 1902.
Peck. Annals of Surgery, 1909, l, 100.
Pool. Annals of Surgery, 1912, lv, 485.
Proust. Bull. Soc. anat. de Paris, 1910, lxxxv, 635; Annals of Surgery, 1914, lix, 968.
Riche. Bull. Soc. anat. de Paris, 1904, lxxix, 370; Bull. et mém. soc. de chir. de Paris, 1905, xxxi, 172.
Sultan, G. Deutsch. med. Woch., 1908, xxxiv, 277.
Wagner. Deutsch. Ztschr. f. Chir., 1912, cxix, 222.

REMOVAL BY CAFFEIN OF SOME DIGITALIS ARRHYTHMIAS: ILLUSTRATED BY TRACINGS.

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When digitalis is administered in cases of heart failure in which the auricles are fibrillating the gross irregularity of the ventricle observed in this condition is not materially lessened, although, as is well known, the rate of the heart beat is greatly slowed and the subjective symptoms are often magically ameliorated.

In cases of heart failure in which the rhythm is normal, digitalis slows the pulse only moderately, and what is of considerable interest, tends often to induce irregularities of several different kinds, chief of which are premature contraction and heart block. I have observed in several instances of marked heart failure after prolonged use of digitalis the appearance of dicrotism, and when this dicrotism is unaccompanied by pulsus alternans it is removed by caffein.

Premature contractions produced by digitalis are fairly common, and are usually of ventricular origin. Partial heart block following digitalis is also very common. In some cases of digitalis block the *As–Vs* interval is found widened previously to or concomitantly with the block, while in other cases this phenomenon is not observed. Partial heart block and premature contractions following digitalis are often associated.

Digitalis heart block has been attributed by some to reduction of conductivity of the auriculoventricular bundle, by others to increase of vagus inhibition. In favor of the latter hypothesis is the fact that the block can be partly removed by atropin; in favor of the former view is the fact that in auricular fibrillation digitalis slows the heart chiefly by depressing the conductivity of the bundle. As a matter of fact, both factors may be involved, and in the present state of our knowledge we cannot define absolutely their relative values.

Digitalis is known to slow the heart rate while caffein accelerates it. If the slowing by digitalis is partly produced by lowering the irritability of the conduction system the effect of caffein in accelerating the rate is partly due to an opposite effect. Caffein tends to raise the irritability of the conducting system. It should therefore theoretically neutralize or possibly overcome the effects of digitalis upon the heart. My investigations have tended to show that the cardiac effects of digitalis, particularly in respect to interference with conduction, are quickly overcome by caffein. For some time past in the hospital wards I have observed the effects of caffein in cases which showed digitalis arrhythmias, and the following seven cases

briefly reported are selected from a considerable number to show that the theoretical considerations above mentioned are borne out by the facts.

Digitalis irregularities will usually cease spontaneously if the drug is stopped, but sometimes instances arise in which, unfortunately, the drug has been prolonged in its administration until the toxic effects upon the conducting system are only too manifest, and in these the administration of caffein will do good.

The first two cases show pulsus bigeminus, due to extreme dicrotism under circumstances of great enfeeblement of contractility. The second case shows marked pulsus alternans. This case died suddenly at the time when the experiment of administering caffein was about to be tried, and the tracing is shown because it is similar to Case I with respect to dicrotism; but there is one important difference, and that is that in Case II pulsus alternans is present, which is, under all circumstances, of extremely grave augury. In Case I the arrhythmia disappeared as soon as caffein was given.

Two cases are given in which block arose as a result of digitalis administration and one of spontaneous block. In all, the phenomenon of block was readily removed by caffein, as the tracings show.

I have seen block removed by caffein at times even while digitalis was being taken. It would appear that partial heart block or premature contraction is the rule rather than the exception when digitalis is kept up even in moderate doses for a long period of time in cases of heart failure with normal rhythm, and it is my experience that these disturbances of rhythm can be quickly removed by caffein.

One case of auricular fibrillation is given to show that caffein has no effect upon the irregularity itself any more than has digitalis, but nevertheless the rate increases under caffein even during digitalis administration, which tends to show, I believe, that the conductivity of the bundle of His lowered by digitalis is increased by caffein.

CASE I.— *Dicrotic pulsus bigeminus occurring in a case of heart failure; normal rhythm; prolonged digitalis administration; recovery.*

C. B. entered hospital November 12. From date of admission, November 12, to January 12, a period of two months, the patient ingested 7 grams of powdered digitalis and 3 ounces of the tincture. On January 7 a tracing was taken (*a b*) which showed marked dicrotism.

January 13 digitalis was stopped and caffein sodium citrate, grs. iij, t. i. d, substituted.

January 18 a tracing of the radial pulse showed an almost complete disappearance of dicrotism (*v c*). Concomitantly with this there was an improvement in the patient's condition.

January 31 strips of radial pulse tracings taken on this day showed a complete absence of dicrotism (*v d e*). The pulse was regular and beating 72 to 80 per minute. Patient left the hospital apparently cured.

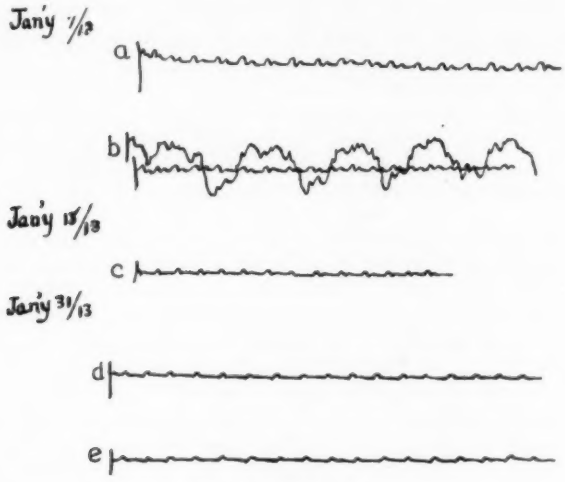


FIG. 1.—Case I, C. B.

CASE II.—*Dicrotic pulsus bigeminus with pulsus alternans; extreme heart failure; rapid but normal rhythm; prolonged digitalis administration; sudden death.*

J. H. entered hospital January 13. Between admission to hospital and February 5 he received 49 ounces of tincture of digitalis. On February 6 he was given powdered digitalis, and up to February 22 he took 8½ grams.

Feb. 20

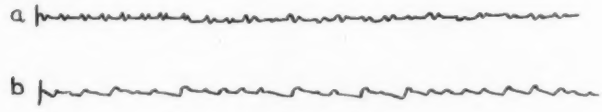


FIG. 2.—Case II, J. H.

On February 20 radial pulse tracings were taken. It was impossible to obtain jugular tracings on account of extreme respiratory distress. The radial pulse was dicrotic and showed pulsus alternans (*v a b*). He died suddenly during the night of February 22.

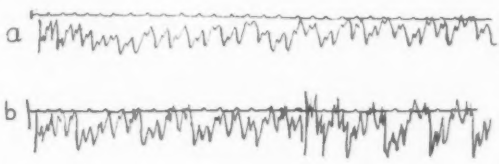
CASE III.—*Heart failure with normal rhythm; partial heart block and pulsus bigeminus removed by caffein; exitus.*

H. S. entered hospital September 6. September 27 a pulse tracing showed feeble rapid pulsations but normal rhythm. Jugular tracing shows absence of *v* waves (*v a b*). From the date of admission, September 6, until January 19, a period of 135 days, the patient took in all 10 grains of strychnin, 540 grains of caffein citrate, and 33 ounces (one quart) of infusion of digitalis. On

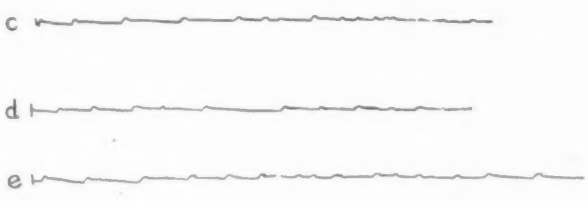
January 20 a tracing of the radial pulse showed partial heart block with occasional slight tendency to dicrotism and bigeminism (*v c d e*). Digitalis was stopped on January 21 and caffein sodium benzoate grs. iij, opium gr. ss, and calomel gr. ss, t. i. d., substituted.

January 27 the polygraphic record showed complete disappearance of the block.

Sept. 27, 1912



Jan. 20, 1913



Feb. 15, 1913

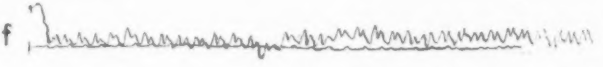


FIG. 3.—Case III, H. S.

A tracing taken on February 15 showed no block. The radial pulse was extremely small and showed a trace of dicrotism (*v f*). For five days preceding February 15 digitalis had been again given, ℥xv, t. i. d. The patient died soon afterward and autopsy showed a much dilated heart, with extremely thin, flabby musculature and wide, patulous mitral orifice.

CASE IV.—*Auricular fibrillation; digitalis slowed the pulse but did not abolish the irregularity; the rhythm was unaffected by caffein.*

This case, which was entirely similar to others observed in this regard, demonstrates that caffein is apparently without effect upon the rhythm of auricular fibrillation.

Kate G., aged sixty years, entered hospital on January 21. A tracing taken on January 23 showed the auricles were fibrillating. The pulse was rapid and extremely irregular, and there was a total absence of *a* wave in the jugular tracing (*v a*). The patient was put on tr. digitalis, ℥x, t. i. d., for a week.

January 27. A strip of radial tracing showed no change (*v b*).

January 30. Tracings taken and conditions found unchanged (*v c*).

February 6. Tracing taken and the conditions the same (*v d*). Caffein sodium citrate began, gr. iij, t. i. d., on February 7 and continued until February 19. No change was noted.

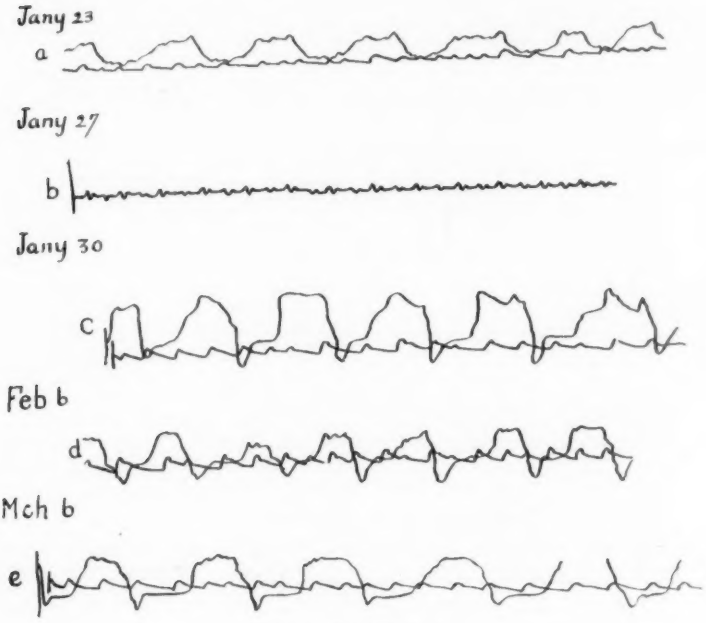


FIG. 4.—Case IV, K. G.

March 6. Tracing taken. Result unchanged (*v e*). Patient was put back upon digitalis February 19, one dose per day of 10 minims, which was found sufficient to keep the heart slowed and ameliorate the subjective symptoms. Patient was discharged about the middle of March.

CASE V.—*Heart failure accompanying mitral insufficiency with a secondary tricuspid regurgitation; normal rhythm; premature contractions and partial heart block produced by digitalis; removal by caffein.*

J. J. entered hospital January 25. Tracings were taken January 27 and showed practically normal rhythm (*v a*). The patient was put on tincture of digitalis, ℥xv, t. i. d. Nine days later, February 6, tracings were taken, all of which showed premature contractions and partial block.

February 6. Digitalis was discontinued and caffein sodium citrate, grs. iij, t. i. d., substituted (*v b c d*).

February 10. Strips of radial pulse tracing were taken and showed complete disappearance of the arrhythmia (*v e f*).

Jan. 27

a

Feb. 6

b

c

d

Feb. 10

e

f

FIG. 5.—Case V, J. J.

Feb. 10

a

b

Feb. 12

c

d

FIG. 6.—Case VI, Mrs. D.

CASE VI.—*Partial heart block of sino-auricular type produced by digitalis in a case of moderate heart failure in a pregnant woman; normal rhythm; removal of block by caffein.*

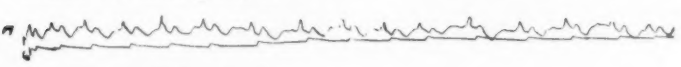
Mrs. D. entered hospital in March. She was near term and suffering from symptoms of heart failure accompanying mitral regurgitation. The cardiac rhythm was normal. The patient was given tincture of digitalis, ℥x, t. i. d., and kept upon it for for some time.

Tracings taken February 10 showed partial heart block (*v a b*). Digitalis was immediately stopped and caffein sodium citrate, grs. iij, t. i. d., substituted. Two days later tracings showed complete absence of the arrhythmia (*v c d*).

CASE VII.—*Spontaneous heart block with pulse rate of about 46 to 48; caffein diminished the block and raised the pulse frequency to 74 to 76.*

Admitted to hospital March 14. Patient was an elderly man. Tracings taken March 18 showed 2 to 1 heart block (*v a*). He was

March 18, radial pulse 46



March 23, radial pulse 74

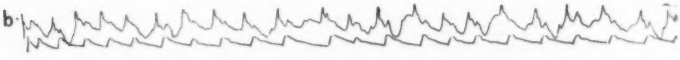


FIG. 7.—Case VII, G. W. T.

given caffein sodium citrate, gr. v, t. i. d. A tracing taken five days later, March 23, showed almost complete disappearance of the block. Pulse increased to 74 (*v b*).

CASE VIII.—Spontaneous heart block.

CONCLUSION. All the irregularities of the heart beat which are brought about by digitalis tend to be removed by caffein. Although in many cases digitalis arrhythmia will spontaneously disappear when the drug is stopped, instances arise, unfortunately too common, in which after prolonged digitalis administration the conductive system is so depressed that serious results may arise. Under these circumstances the administration of caffein will be of service and therefore strongly indicated. The action appears to be due to the increase in irritability of the conduction system produced by the caffein, which antagonizes and finally overcomes the depressing effects which digitalis exerts upon the auriculo-ventricular bundle.

BRAIN SYPHILIS.

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In considering a disease as essentially polymorphic as syphilis of the central nervous system, it is not surprising that apart from certain well-defined clinical and microscopic pictures there should be observed conditions not so clearly defined, forming through the coexistence of different manifestations of these would-be entities, cases that cannot clinically or pathologically be diagnosed according to hard and fast lines.

Duchenne,[1] in 1859, observed that "some (ataxic) patient had suffered from syphilis." A few years later Schultze pointed out the importance of the association of syphilis with ataxia, and in 1876 Fournier insisted on the frequency of a previous history of syphilis in tabetics. Raymond[2] stated, "It is not proved, but it is extremely probable, that syphilis has a part direct or indirect in the causation of tabes dorsalis when this disease shows itself in syphilitics." Vulpian, Erb, and Gowers each subsequently contributed extensively in support of the view of Fournier. General paralysis had likewise been associated with syphilis, but we do not find the connection as definitely stated except by Fournier,[3] who in his classification of syphilis of the central nervous system included tabes, general paralysis of the insane, special forms of epilepsy, and muscular dystrophies. Ford Robertson advanced the view that general paralysis was the result of a bacterial toxic infection from the respiratory and alimentary tracts, owing to the impairment of the resisting powers of the organism by syphilis, alcoholism, or excessive use of nitrogenous foods. Ferrier[4] stated, "We are dealing with merely different aspects of the same polymorphic disease." Mott maintained "that etiologically and pathogenetically there is one tabes which may begin in the brain (especially in certain regions), or in the spinal cord in certain regions, or in the peripheral nervous structures connected with the viscera, constituting, therefore, different types, any of which may be present or be associated with one or all of the others." Moebius and Shaffer made no less positive statements. Lang and Neisser were the first to ascribe the dependence of the tertiary lesion of syphilis to the activity of the virus. To Lang also is due the credit of having first noted the occurrence of meningeal involvement with general dissemination of

[1] Arch. gén. de méd., ser. V, 1859, 439.
[2] Le Progrès Médicale, 1892, 453.
[3] Gazette Médicale de Paris, 1876, No. 53.
[4] Lancet, 1906, 951.

the virus. Thus the concept of syphilitic disease of the central nervous system has, more especially since the discovery of modern microscopic and serological methods, gradually been enlarged, until today it includes not only possible syphilitic entities of the central nervous system, but also conditions simulating most every other known possible disease of that system.

Long before the discovery of the Spirocheta pallida by Schaudinn and their demonstration by Noguchi and Moore, Moebius and Erb advanced the theory of the possibility of a form of the syphilitic virus falling with special incidence on the spinal and cerebral centres and leading in due course to tabes or general paralysis to account for the different manifestations of the effects of syphilitic inoculation. Brosius related the history of seven glass-blowers infected in the mouth from the same source in 1891. After twelve years five came under his observation again. One was tabetic; a second had signs of general paresis; the third was a marked general paretic; the fourth had indications of tabo-paresis; the fifth was still in good health. Raymond reported a case of two brothers syphilized at the same time; one lead a fast life and indulged in sexual excess and later developed tabes; the other led an industrious life accompanied with many financial worries and later developed general paresis. Souques described a family in which the father was syphilitic and became a general paretic; the mother became a tabetic and two young daughters also showed signs of tabes. Morell-Lavallée described the case of one woman who infected five men, four of whom developed general paresis and the fifth syphilitic meningitis. Mott mentioned two men syphilized by the same nurse, and ten years later both developed general paralysis, while Marie and Bernard described two men who had acquired syphilis from the same source and who later developed tabes dorsalis.

Noguchi found some evidence for the possibility of considering a special strain in the fact that the organisms obtained from cases of general paresis had markedly long periods of incubation. As an explanation of this surely a possible attenuation or modification of the virus must be considered. From the present data and knowledge of the essential similarity of the microscopic findings there is strong evidence that the general or focal character of the lesions depends upon certain conditions. Where the vitality of any given part is lessened, as by impaired blood supply or by trauma, this part is more favorable for spirochetal development. In other instances it appears that the syphilitic process in attacking a certain definite region of the central nervous system has less tendency to become a general process, and does so almost to the exclusion of other parts. That the location of the virus is of variable intensity has been demonstrated by Levaditi, A. Marie, and Bankowski[5] who stated

[5] Annales de l'Institute Pasteur, Juilliet, 1913.

"the abundance of parasites varies greatly from one case to the other; at times the treponema are exceedingly abundant, at times very rare. They are generally grouped in 'foyers,' more or less circumscribed, especially in the anterior regions of the cortex, but have also been seen in the bulb, cord, and spinal ganglia." It has long been considered that not only different individuals but even different races offer increased resistance to the Treponema pallidum, and it has been proved that even the tissues of the body show varying resistance, the heart showing little and frequently no response to the presence of the organism. Can not the absence of correlation between the severity of the early manifestation of syphilitic infection and the late ones, and also between the time of inoculation and the period of onset of the symptoms, be explained by individual resistance or possible immunization as well as by the theory of different strains of the virus? How is one to account for the simultaneous occurrence of combined involvement of different parts of the central nervous system and for the exacerbation of spirochetal involvement at the site of trauma? The former possibly on the theory of a mixed infection or strain, but certainly the latter on the evidence of lowered resistance of the part affected. Of common observation is the fact that many infected with syphilis who exhibit early symptoms that are so mild and frequently so slight that they may be unaware of them may develop severe disease of the central nervous system, whereas others with pronounced early manifestations may give no evidence of involvement of the central nervous system. The idea has been advanced that the virus having spent itself in early proliferation left an attenuated organism unable to affect severely the nervous tissues. Here again we may be dealing with an especially resistant nervous system, or the infected individual may have died of some incurrent infection before the breaking down of this resistance. Kern[6] stated that his findings of 85 per cent. of either the asthenic or emphysematous type of patients in his cases of tabes has convinced him that tabes should be designated "spinal syphilis with constitutional inferiority, predominately of the asthenic type." Mott[7] first observed that in spite of sexual promiscuity of many general paretics in the early stages of the disease he had never seen a primary sore in such an individual, and later Krafft-Ebing, as proof that the body is immunized by one infection, selected nine patients with general paralysis of the insane, and inoculated them by injecting the virus from a typical hard chancre; none of them developed syphilis, showing that they had become insusceptible to the disease.

The variability in time of onset of symptoms after inoculation may be of diagnostic importance in differentiating the types of syphilitic disease of the brain, but here again one is dealing with

[6] Therap. Monat., Berlin, 1914.
[7] Proc. Roy. Soc. Med., 1909–10, vol. iii.

an unreliable factor. Blumel, Schaffer, and Nonne have reported cases of tabes occurring as early as one to one and a half years after infection. Frey observed tabetic symptoms in the third and fourth month after infection. Spiller has observed two cases of syphilis of the central nervous system while the rash was still on the body, one being a case of Brown-Séquard paralysis and the other a hemiplegia. Manifestations of syphilis of the brain have been quoted as occurring as early as four months after infection, and one case of general paresis has been described by Nonne as occurring as late as thirty years after infection.

The symptomatic manifestations of syphilitic disease of the central nervous system are aside from clear-cut cases equally as relative and depend upon the localization of the syphilitic process and the susceptibility of the tissues. Disease of the optic nerve manifested by varying degrees of impaired vision and transitory or permanent amaurosis is observed in all syphilitic disease of the central nervous system. The frequency of loss of pupillary reaction to light with preservation of the reaction to accommodation observed by Argyll-Robertson in 1869 was first associated with tabes by Erb. Gowers,[8] in 1881, stated "That it may be taken as a practical rule that, apart from general paralysis of the insane, reflex iridoplegia always indicates either syphilis or tabes." Today the Argyll-Robertson pupil is considered the most common manifestation of parenchymatous syphilis, and it is found in cases of general paralysis and cerebral syphilis. That the Argyll-Robertson pupil is no longer absolutely diagnostic of syphilitic involvement of the nervous system is shown by the observation of Vincent,[9] who has reported a case of unilateral Argyll-Robertson pupil as the result of trauma; by that of Nonne and Wohlivell,[10] who reported its occurrence in alcoholism, and also that of Dejerine and Mirallee,[11] Sicard and Galezowski,[12] who reported a unilateral Argyll-Robertson pupil occurring in a case of syringomyelia. Mydriasis commonly found in cerebral syphilis is likewise found in general paresis, and anisocoria is seen in all types of syphilitic disease of the central nervous system, but neither is pathognomonic. Disease of any of the other cranial nerves has been observed in all types of syphilitic involvement of the central nervous system. The tendon reflexes may be lost or increased again, dependent upon the localization of the process. Transitory or permanent amaurosis, aphasia and hemiplegia, are common both in general paresis and cerebral syphilis, hemiplegia likewise not infrequently being a complication of tabes.

Epileptic convulsions, focal or diffuse, are seen in syphilitic meningitis, cerebral syphilis, and general paresis, Marinesco and

[8] Lancet, 1881, 95.
[9] Revue Societe de Neurologie, June, 1910.
[10] Neurologische Centralblatt, May 16, 1914.
[11] Revue Neurologique, July 30, 1913, 105.
[12] Ibid.

Minea[13] recently reporting a case of general paresis dying during epileptic convulsion, and Nonne two cases in which epilepsy preceded tabes dorsalis. To the pain due to tabetic root lesions we have a simile in the cephalgias frequently observed in general paresis and cerebral syphilis, and so long considered to be of increased nocturnal severity in character. Considering the diffuse lesions of general paresis the changes of character and the psychical manifestations exhibited by these patients is not to be wondered at; but one frequently sees similar phenomena in cases showing evidences of focal involvement, and the severity of the symptomatology is not always indicative of the extent of the process in the nervous tissue, it being frequently impossible to pronounce beforehand a marked or slight, diffuse or focal, anatomical involvement. The stand of M. Nonne is indeed somewhat obscure, as is shown in his conclusions of a case presenting symptoms of neurasthenia with periods of depression: The serological examination in this case showed the Wassermann test to be positive on the blood and spinal fluid, with a lymphocytic count of 33/3 in the spinal fluid. The microscopic findings were infiltration of the pia mater and of the vessel sheaths of the small vessels in the cord and cerebral cortex with round cells and a few plasma cells, and the changes in the nervous tissue were distinctly focal in character. He asks, "Was one justified in diagnosing this a case of cerebral syphilis? on this depending upon what we until now, and as I myself mean, clinically considered as cerebral syphilis, my answer is No, for we have here no symptomatology of localized syphilitic changes, but, on the contrary, in a clinical sense, only evidence of diffuse involvement."

Of the manifestations due to the loss of the cortical inhibitory control commonly observed in the diffuse lesions of general paresis we also find evidences in the more localized changes of cerebral syphilis, and trophic disturbances may be observed in any syphilitic involvement of the central nervous system.

Just as it has been shown that the Treponema pallidum is the causative agent of the early and late manifestation of syphilitic disease of the body, so also is it found that the characteristic reaction produced irrespective of location or time of involvement consists in a perivascular infiltration of mononuclear lymphocytes and plasma cells with proliferation of the walls of the affected vessels and subsequent degeneration of the surrounding tissue, due either to the presence of the organism itself or to the metabolic changes resulting from the disturbed vascular condition. The ultimate result of the presence of the organism in the nervous system being a neuronic degeneration, whether of the spinal sensory neuron, as in tabes, the cortical association neuron, as in general paralysis, the visual neuron,

[13] Reunion Biologique de Buerest, Mars 6, 1913.

as in primary optic atrophy, the upper motor neuron, as in primary lateral sclerosis, or the lower motor neuron, as in progressive muscular atrophy. The miscroscopic findings today generally considered as diagnostic of general paresis are those of a diffuse parenchymatous syphilis with loss of tangential fibers, neuroglia overgrowth, infiltration of the sheaths of the smaller vessels, with mononuclear lymphocytes and plasma cells, possible disturbance of the cortical lamellation, and occasional focal exacerbations. Cerebral syphilis or mesoblastic syphilis is considered to be either vascular, meningeal, or gummatous.

In an examination of the pathological material of fifty-three cases, including tabes, tabo-paresis, general paralysis of the insane, cerebral syphilis, and syphilitic meningitis in the Laboratory of Neuropathology of the University of Pennsylvania, I was impressed by the similarity of the pictures. In all one finds to a greater or less extent an infiltration of the meninges and the sheaths of the smaller vessels of the central nervous system by mononuclear lymphocytes and plasma cells, and further, this infiltration in general paresis does not confine itself to the vessel sheaths or in cerebral syphilis to the surface of the central nervous system. In considering the degree of degeneration of the nerve cells, one must realize that he is dealing with a variable quantity and not too freely describe diminution or loss of the nerve cells. Of the chromophilic granular changes of the cells, one frequently finds most pronounced focal changes in general paralysis, and not infrequently severe symptomatic evidence of general paralysis and cerebral syphilis, with little or no changes in the granular cellular arrangement. A disturbance of cortical lamellation is seen only in severe advanced cases and consequently can not be pathognomonic. In considering a loss of the tangential fibers and glial overgrowth one is again dealing with the relative. Not uncommonly in either general paralysis or cerebral syphilis there is a pronounced lack of correlation between the symptomatic and microscopic findings. It may be possible that the explanation why some alienists can so readily diagnose between general paralysis and cerebral syphilis may lie in the fact that patients with early or intermediate states rarely find admission to insane hospitals, and their experience has been gained chiefly from advanced types.

Just as the causative agent and the tissue reaction in syphilis of the central nervous system are similar, so also are the laboratory findings in the serological tests, the characteristic findings in the spinal fluid being a lymphocytosis and an increase of the globulin and albumin. It was at one time held that the Wassermann test was alike positive on the blood serum of general paresis and cerebral syphilis, but was as frequently negative on the cerebrospinal fluid in cerebral syphilis as positive in general paresis, and further, that marked lymphocytosis was more frequently found in cerebral

syphilis. Nonne[14] makes the following statement: "In general paresis the Wassermann on the blood serum is positive in 100 per cent. of the cases; on the cerebral spinal fluid using 0.2 c.c. of the fluid in 90 to 95 per cent., and using 1 c.c. in a 100 per cent., phase 1 is positive in 95 to 100 per cent. of the cases. In cerebral syphilis the blood serum is positive in 70 to 80 per cent. of the cases; on the cerebral spinal fluid by the original method in 20 per cent. of the cases, and by Hauptmann's method in 100 per cent. phase 1 is always positive." Feldes and McIntosh[15] state: "A positive reaction in the fluid indicates a syphilitic lesion of the central nervous system. In active untreated cases of dementia paralytica, tabes dorsalis, and cerebral syphilis the reaction is positive both in the serum and cerebral spinal fluid. In cerebral syphilis without involvement of the spinal cord the cerebrospinal fluid is negative. Except in the latter cases the strength of the reaction has no certain diagnostic value. The reaction is apt to be negative in the serum or cerebrospinal fluid in the cases of hemiplegia, non-progressive tabes dorsalis, and old lesions of the nervous system, especially in cases of stationary congenital syphilis." Kirchberg[16] found in an examination of one hundred cases of general paretics the Wassermann reaction to be positive on the fluid in 78 per cent. of the cases and on the blood in 93 per cent. He concluded that the diagnosis of general paralysis should never be excluded because of a negative Wassermann reaction, and inasmuch as eleven of the twenty-two cases showing negative Wassermann were tabo-paretics, the Wassermann reaction could no longer be used as a differential point between tabes and general paresis. Mitchell, Darling, and Newcomb in an examination of the lymphocytosis of the spinal fluid in clinical cases of syphilis of the central nervous system found counts as high as 120 and as low as 0 in cases of general paresis.

I wish to express my thanks to Dr. William G. Spiller for placing the above material at my disposal and for many kind suggestions in the preparation of this paper.

PERMANENT PARTIAL COMPRESSION OF BOTH COMMON CAROTIDS IN EPILEPSY: A REPORT OF EIGHT OPERATIONS.

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Ligation of the large afferent vessels of the brain for the relief of epilepsy is not a new procedure. Although such operations have

[14] Diagnose and Therapie der Syphilogenen Erkrankungen des Zentralnerven Systems.
[15] Brain, 1913, xxxvi, 193. [16] Archiv f. Psych. u. Nerven., 1914.

never received anything approaching general recognition, one may find in a search of the literature embracing the last few decades record of many instances of ligation of one or more of the large arteries of the neck in epileptics.

Baracz,[1] Sommer,[2] Binswanger,[3] Wyeth,[4] Hasse,[5] and Alexander[6] have mentioned the favorable effect upon general epilepsy which may be induced by ligation of the carotids or vertebrals. Many years ago Wyeth observed that "since dilatation of the arterioles and capillaries of the medulla oblongata is accepted by Schroeder, van der Kolk, Neimeyer, and others as the most constant lesion in epilepsy, I would suggest, and would perform if the opportunity presents, deligation of both vertebral arteries. This would arrest the direct and probably irritating flow of the blood through this ganglion, leaving the recurrent flow from the carotids through the posterior communicating arteries to supply the necessary amount of nutrition to this portion of the encephalon."

Alexander, of Liverpool, ligated the vertebral arteries in epilepsy with what seemed at first to be excellent effect, but later reported this method to be without value (Binswanger and Momburg). The investigations of Ritters[7] sought to explain the failure of veretebral ligation. They apparently made clear that the vertebral arteries play an unimportant role in the blood supply of the brain. The carotids, according to Ritters, conduct almost all of the blood to the brain.

Delegeniere[8] observed excellent results in a case of epilepsy following ligation of the superior longitudinal sinus just above the torcular Herophili. During a trephining it became necessary to ligate the longitudinal sinus to prevent hemorrhage. Delegeniere regards epilepsy as a clinical syndrome common to many pathological conditions, and holds that the many causative lesions of epilepsy produce in different ways a permanent dilatation of the veins upon the surface of the cerebral hemispheres. He, therefore, regards it a logical step to modify the venous circulation of the cortex by ligation of the terminal portion of the longitudinal sinus in the belief that distention of the superficial cerebral veins is the cause of irritation of the cortex. He regards this operation as analogous in its purpose and mode of action to ligation of the upper part of the internal saphenous vein for varicosities of the veins of the leg, that is, placing a ligature around the longitudinal sinus would, he says, bring about a collapse of the overdistended veins which supply the sinus.

Jonnesco, von Jacksch, Spratling and Park, Joseph Beck, and a

[1] Wien. med. Wchnschr., 1889
[2] Die Epilepsie.
[3] Krankheiten des Nervensystems, 297.
[4] Gowers, Dis. of Nerv. Sys., vol. ii.
[5] Arch. Prov. de Chir., 1914, No. 10.
[6] Virchows Arch., 1890, cxix, 2, 362.
[7] Essays in Surgical Anatomy.
[8] Verh. d. Ges. f. Chir., 1913.

number of others have performed cervical sympathectomy in general epilepsy with a view to cutting off sensory stimulation from the viscera and especially to influence directly the circulation of the brain by changes in the caliber of its bloodvessels through the action of the vascular nerves.

Lafforgue[9] observed in rabbits as a direct result of stimulation of the cervical sympathetics, spasmodic ischemia of the whole cerebrum, cerebellum, and medulla oblongata.

Jonnesco concluded that the cervical sympathetics contained vasoconstrictor fibers for the head, face, and heart. This was made evident by electric excitation. What is more important in this connection, Jonnesco further noted that the cervical sympathetics contained vasodilators for the inner part of the cheeks, gums and lips and for the brain. This was shown by the application of feeble currents.

Winters' table shows that of 122 cases of general epilepsy, treated by cervical sympathectomy, 6.6 per cent. were cured, 13.9 per cent. were preliminarily cured, 18.9 per cent. improved, 54.9 per cent. not improved, and 5.7 per cent. died.

The pathogenesis of epilepsy is obscure, and we are still ignorant of the cause of the attack. Many writers consider it unlikely that a palpable anatomical alteration exists. Orloff[10] found no characteristic changes except thickening of the glia, especially in Ammon's horn, possibly a congenital sclerosis.

The claim of Chaslin that a gliosis is to be regarded as the cause of epilepsy is, as stated by Hirt, by no means proved. Much more plausible is the theory that the amount of blood in the brain is of some importance in this connection.

Turner[11] says that the exciting cause of epileptic attacks is a sudden stasis in the blood stream, usually in a limited portion of the cortex.

Bechterew believes that there is an increased blood flow to the brain and a temporary dilatation of the capillaries during the attack. Bechterew's views were based upon the experiments of Todorsky.[12] On the other hand, von Leyden and Sommer noted evidence that the exciting cause of the epileptic attack is anemia of the brain. The former observed epileptic attacks in cases of aortic stenosis undoubtedly as the result of a temporarily insufficient blood supply, and the latter remarked their occurrence in a case of ankylosis of the atlas which had produced narrowing of the vertebral canal in its upper portion.

It has been observed that sodium santoninate injected into rabbits quickens the pulse and respiration. The rabbits' ears become

[9] Quoted by Spratling and Park, Jour. Nerv. and Ment. Dis., April, 1914.
[10] Archiv. f. Pschiatrie and Nerven Krankheiten, vol. xxxviii, Heft 2.
[11] Jour. Mental Science, vol. liii, No. 220.
[12] Hirt, Diseases of General Nervous System, 586.

redder and hotter, due to the increased blood supply. This is followed by fine fibrillary contractions. With larger doses, convulsions appear with clonic spasmodic movements followed by return to the normal. Jelliffe[13] found in rabbits thus injected with santonin, intense conjestion of the meninges and of all the cerebral vessels, large and small.

Permanent narrowing of both common carotids was adopted by Momburg[14] for the relief of epilepsy in 2 cases. Coming accidentally upon an epileptic during a seizure in the street, it occurred to him to apply digital compression to both carotids to determine the effect of such compression upon the typical clonic contractions which were present. With thumb and forefinger he compressed both common carotids and almost immediately the convulsive movements ceased, the man drew a deep breath, opened his eyes, looked about, and seemed to be conscious. While being carried into a neighboring house the convulsions reappeared, but compression of the carotids with both thumbs again caused the contractions to cease and consciousness to return.

Epileptic convulsions had previously been controlled through digital compression by others. Binswanger speaks of it in his work on epilepsy as having been recommended by von Reimer in the middle of the last century, and later by Corning. Hasse, according to Momburg, regarded the procedure as difficult, and had observed no successful trials of it. At the suggestion of Momburg, Volland was successful in several instances in controlling epileptic attacks by digital compression of the carotids. He observed, as did Hasse, that it is not always easy thus to compress the carotids, owing to the thick neck musculature and the deep position of the vessels. My colleague at the Indianapolis City Hospital, Dr. Will C. Moore, succeeded in arresting the attack in a single instance by digital compression of the carotids.

Momburg permanently narrowed the common carotids in 2 cases with silver wire loops, proceeding from the convenient hypothesis that in epileptics the seat of the disease is represented by the entire brain, and may be looked upon as an abnormal state of irritability, and that this irritability may be decreased by decreasing the blood supply and by decreasing the nutrition to lower the irritability of cells without effecting the vitality of such cells.

Momburg operated under novocain suprarenin anesthesia, compressing both carotids by twisting the crossed ends of a silver wire loop until the temporal pulse became barely perceptible on the corresponding side. He operated on 2 cases, one in February and one in March, 1914. Distinct improvement followed in both instances. His published article in the *Deutsche medizinische Wochenschrift* appeared within less than two months after the

[13] Jour. Mental and Nerv. Dis., 1909, p. 252.
[14] Deutsch. med. Wnschr., April, 1914.

first operation and within one month after the second. It need hardly be said that a report made so soon after such an operation must be looked upon as of somewhat doubtful value for several reasons, two of which are that sufficient time did not elapse for the development of compensatory dilatation of the other vessels and establishment of collateral circulation, and that such temporary beneficial results will, as has been noted frequently by neurologists, follow the performance of almost any operation upon an epileptic.

During August, 1914, I compressed both common carotids in 2 cases of general epilepsy, the plan followed being in most respects that adopted by Momburg. I did not employ local anesthesia in the first case for the reason that the attacks were so frequent, occurring as often as seven times a day, that I feared the onset of an attack might lead to a serious surgical accident. Silver wire, 1 mm. in thickness, was passed under each common carotid, a short loop was cut off, and the ends were twisted until the temporal pulse on each side became so slight as to be just perceptible. A catgut strand was tied to the twisted ends of the wire and left hanging out of the wound to be used as a guide in case threatening cerebral symptoms should require immediate removal of the wire. With the catgut strand the wire loop can be drawn up into the wound and snipped off with blunt-end scissors quickly and without anesthetic of any kind.

Of these two first cases, one was in a young man, aged twenty years, who had suffered five or six attacks of the grand mal type daily. The other case was that of a girl, aged seventeen years, whose attacks, though much less frequent, were also of the severer form. Partial compression of both common carotids produced in neither of these cases any untoward effects. Both patients slept soundly, as might have been expected in view of the decreased blood supply to the brain, for about eighteen hours. In both cases the result although gratifying, so far as the effect upon the frequency and character of the attacks is concerned, left much to be desired. The young man, though distinctly benefited, has had since the operation attacks of petit mal, in the average, one and one-half times a week. During the last month he has had but two attacks. Previous to operation the attacks, as stated above, occurred several times daily and were of severer form. In the case of the young girl, there has been a slight increase in the length of the interval between the attacks, and the character of the epilepsy has been changed for the time at least from grand mal to mild petit mal.

In the first week of November, 1914, I narrowed both common carotids with silver wire after the plan described above in two additional cases. One was a case of petit mal in a man, aged thirty-five years, the other a case of grand mal of the severest character and of long-standing in a woman, aged forty-six years. The man, of thirty-five with petit mal was apparently somewhat improved

in that the interval between attacks was more than doubled in length. The severity of the attack was reduced. The result in the case of a woman of forty-six with grand mal was a complete failure. She developed coma immediately following the operation and the silver wire loops were removed, one within twenty-four hours after operation and the other four days later. Upon gradual recovery from the coma during the next two or three days following operation a complete hemiplegia of the right side made itself manifest with aphasia, from which the patient is now slowly recovering.

January 10, 1915, I operated on a fifth case in the manner described. The patient was a man, aged thirty-three years. He had suffered daily severe attacks following a blow upon the head over the upper Rolandic area on the right side. A decompression had been made without benefit. In the period of seven weeks elapsing since the carotids were compressed he had had no attacks whatever. Since such a short period of respite may follow any imaginable operation upon an epileptic, such a temporary improvement may be said to be without great significance.

The sixth case was operated March 6, 1915, the patient being a male negro, aged twenty-seven years. For one year he had suffered attacks of grand mal at intervals of nine days with almost continuous headaches. During the last few months prior to operation the attacks had increased in severity and frequency. Between the date of the operation and April 18 there have been but two attacks, one of petit mal, on March 11, and one of grand mal, on April 10.

Momburg remarks that his results indicate with what safety the blood supply to the brain may be decreased. This is, I believe, slightly misleading, notwithstanding it is frankly added that two observations cannot suffice for the drawing of general deductions. The one serious brain complication in my experience might be attributed, of course, to faulty technique or injudicious case selection, yet it seems justifiable in view of the paucity of actual trials of carotid compression to say that except in youthful persons the sudden decrease in the blood supply to the brain may at any time, for aught we know, give rise to serious cerebral consequences. It should not be forgotten that the very factors upon which hope for success in carotid compression may be based, namely, the meager facilities for the establishment of collateral circulation of the carotis communis and the restriction of the vertebrals in their bony canals represent factors of danger if the blood supply to the brain be decreased too greatly by the compression.

It is unfortunate that in the case of the brain it is not easy to determine by any of the known tests of the efficiency of circulation precisely how much change is induced in the blood supply to the brain by compression of the carotids. Appreciating the great importance of such tests, the ignoring of which may lead to the incurring of serious and fatal errors in operations, one is nevertheless

unable in the case of the common carotid to profit greatly by the employment of such tests. Matas,[15] writing of circulation tests, remarks that "The time has now come when every progressive surgeon must regard it as his obligate duty to investigate and ascertain, by actual tests, what the behavior of the peripheral circulation will be whenever an operation is contemplated in which the parent vascular trunk is liable to be involved. This is no longer a matter of academic or theoretical interest, but a subject of practical, vital importance in the treatment of such cases.

The Pachon blood-pressure method, the test of the venous turgescence, the calorimetric test, and other methods of great value in determining the efficiency of the circulation in the extremities after occlusion of the large trunks are of doubtful practical usefulness in the case of the brain in comparison with the simple expedient of determining the strength of the pulse in the temporal artery. The excellent methods of Matas, particularly that of applying temporarily the aluminum band as a test of efficiency of circulation, would be of greater value in the cases under consideration were it not that the sleep which is probably consequent upon the decreased blood supply to the brain may mask cerebral symptoms which otherwise would give warning of danger

In dogs, both common carotids and one vertebral have been ligated without fatal result, and in man, both common carotids have been ligated, one at a time, with only two weeks elapsing between the operation on the two sides. Stiles gradually occluded both carotids in hydrocephalus, two weeks elapsing between the beginning and the end of the occlusion. J. P. Lord and Frazier have also followed this gradual but complete occlusion plan in hydrocephalus with success, and Fenger[16] completely ligated first one common carotid and then the other with an intervening period of a few hours, and with favorable results.

Dr. E. H. Beckman,[17] of the Mayo Clinic, in a case of aneurysm of the inside of the skull involving the right lateral sinus associated with aneurysm of the left internal carotid artery, ligated at one operation the left common carotid just below the bifurcation and the right external carotid artery. The right and left internal jugular and the left external jugular veins were also ligated. The patient made an uninterrupted recovery and was relieved of pain and throbbing sensations in the head.

The favorable postoperative histories of the cases cited above indicate in what surprising degree the blood supply to the brain may be reduced in certain cases. However, it is by no means established that even gradual or partial occlusion of one common carotid is entirely free from danger of consequent cerebral mischief

[15] Jour. Am. Med. Assn., October 4, 1914.
[16] Ricketts, Surgery of the Thorax.
[17] Trans. West. Surg. Assn., 1914.

and it need hardly be stated that partial occlusion of both carotids should be done with caution.

Instances of compression of the common carotids for epilepsy are so few in number that general conclusions must, of course, be withheld. In view of the extremely unsatisfactory results of non-surgical treatment of general epilepsy the practice of the plan of compression of the common carotids may be considered justifiable, though the procedure at present should be regarded as an experimental one. Unfortunately, today, as centuries ago, we are reduced to the sad necessity of trying many uncertain remedies in epilepsy, trusting that at some time we may hit upon one that is truly efficacious. Certainly carotid compression cannot be considered appropriate in cases in which there is the slightest reason to suspect irritation in any peripheral zone inducing the attack until such peripheral irritation has been excluded. If the operation is worthy of future trial it is in cases of idiopathic general epilepsy, occurring in youthful persons or in traumatic or focal epilepsy which has persisted after cranial decompression, or other appropriate intervention. In such cases the operation may be done without great fear of serious consequences and with considerable hope of benefit.

The circumstance that in three of the six cases operated on by the writer the severity of the attack was reduced, suggests that whereas the increased influx of blood to the brain probably does not bear to the attack the relation of ultimate cause, nevertheless, the sudden influx of blood may determine in some manner the time and also the severity of the attack. Moreover, in view of the accredited fact that peripheral stimuli in almost any zone may induce epilepsy, it is believed that the suddenly increased influx of blood to the brain may represent the agent which activated by such stimuli makes the direct assault upon the cortex. Obviously an earnest effort to locate and correct any cortical lesion or an existing peripheral source of irritation, for example, in a stagnant colon should precede an attempt to reduce the aggregate caliber of the afferent bloodvessels of the brain in general epilepsy.

In conclusion, I desire to express my appreciation of valuable assistance rendered in the preparation of this report by my associates Doctors W. C. Moore and H. K. Bonn.

STATISTICS OF AGE MORTALITY BASED UPON THE NUMBER OF PERSONS ALIVE AT EACH AGE.

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Various ways have been commonly employed to express the mortality from different diseases according to age. One method presents, for a given disease at a given age, the ratio of deaths at

this age to the total number of all deaths from that disease irrespective of age. A second method gives for a specified disease at a given age the ratio of deaths at this age to the total number of deaths from all causes irrespective of age. A third method shows for a given disease at a given age the ratio of deaths at this age to the total number of deaths from all causes occurring at that particular age.

Useful as these methods are for furnishing certain kinds of information, there is a great deal that they do not tell which is revealed by still another method. This method expresses for a certain disease the ratio of the number of persons dying at each age to the whole number of persons alive at the same age; that is, the mortality from the disease for every 10,000 persons living at the particular age. This method furnishes something like an absolute standard. Such figures render one independent of such variable factors as the number of persons living at other age-periods, or dying at the other age-periods or from other diseases. These other factors may be entirely misleading as to the proportion of deaths from a disease among those living at any one age-period.

This is by no means a new method for expressing age mortalities, but is not as generally recognized and employed as it should be. It is often omitted in text-books and other places that have a great opportunity for diffusing knowledge.

The charts presented in this paper are compiled from the United States Census Reports for 1910. The figures presented could not be obtained directly from these reports, but had to be compiled from different volumes, one volume dealing with mortality statistics, which does not give the age mortality per 10,000 persons living at the same age, and the other volume dealing with population statistics. Only the mortality figures for the registration area of the United States have been used, which includes 58.3 per cent. of the total population of the United States. The population statistics for the whole country had to be reduced, therefore, to 58.3 per cent. of their amount, to correspond to the mortality statistics for the registration area.

In all the charts the *dotted* line represents the number of deaths for the disease specified for different decades per 10,000 persons living at corresponding decades, except in the pneumonia chart where this line indicates the mortality per 1000 living persons. The *solid* line represents the ratio of deaths from a particular disease at different decades to the whole number of deaths at all ages from the same disease. The *broken* line in Chart III represents the ratio of deaths from tuberculosis at any decade to the total number of deaths from all causes at the corresponding decade.

The figures at the upper part of the charts indicate the different decades.

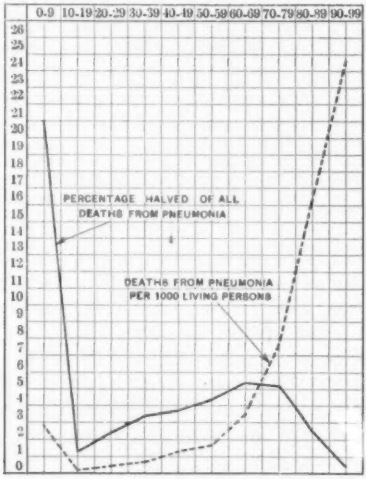

CHART I.—Pneumonia; all forms. Registration area of the United States.

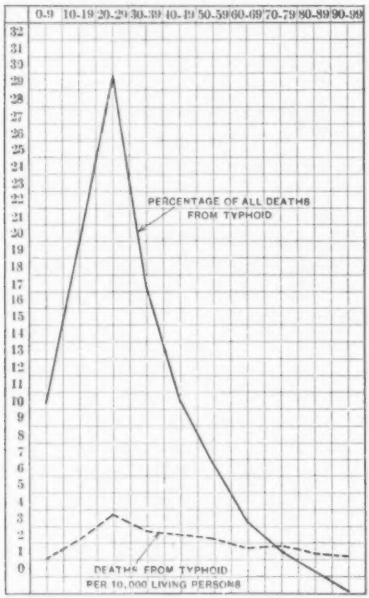

CHART II.—Typhoid fever. Registration area of the United States.

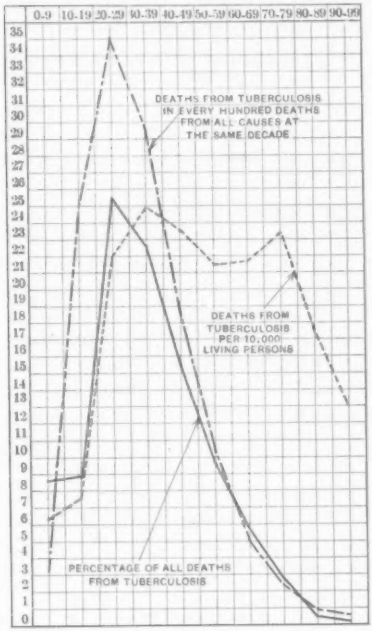

CHART III.—Tuberculosis; all forms. Registration area of the United States.

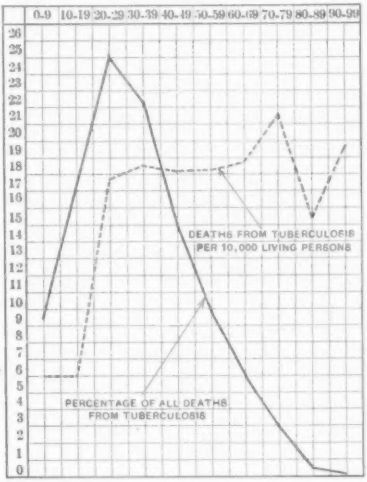

CHART IV.—Tuberculosis; all forms. Pennsylvania.

The figures to the left of the charts correspond to the points on different parts of the curves, and therefore indicate several things: (1) the number of deaths per 10,000 persons living at the specified decade except in Chart I, in which the mortality is expressed in terms of 1000 living persons; (2) the number of deaths due to the particular disease out of every 100 deaths at all ages from the same disease except in Chart I, where the percentage is halved, that is, should be doubled to give the proper percentages; (3) only in Chart III the number of deaths due to a given disease out of every 100 deaths from all causes at the same decade. Figures for those dying at an age over one hundred years or at an unknown age are not shown.

The charts deal with pneumonia, typhoid fever, and tuberculosis for the registration area of the United States, and with tuberculosis for Pennsylvania. Thus Chart I demonstrates how much more frequently persons die of pneumonia during later life, provided the mortality is based on the number of persons living at a corresponding age, and how misleading it would be to draw conclusions from the absolute number of deaths from pneumonia during the later decades. This chart also shows that while the proportion of deaths from pneumonia under ten years of age is high compared to all deaths from pneumonia at all ages, the large number of persons alive at this period materially reduces the relative prevalence of the disease at this decade.

Chart II reveals an interesting picture in regard to typhoid. The curve depicting the high figures for the decade twenty to twenty-nine corresponds to the average teaching that typhoid predominates markedly in youth and early adult life, this particular curve in the chart and the prevalent teaching on the subject being based upon the relation between the number of deaths from typhoid at this period and the total number of deaths from typhoid at all ages. The other curve in the chart shows the number of deaths from typhoid at each decade for each 10,000 persons living at the same decade, the contrasts in this curve being noticeably less striking than in the other curve.

Chart III pictures the mortality curve for all forms of tuberculosis in the registration area of the United States, and shows what has long been known, but is frequently overlooked, that tuberculosis continues unabated its extensive ravages even among elderly persons, though the absolute number of deaths from tuberculosis is actually diminishing. Among those who have emphasized the high mortality from tuberculosis among the aged are Wilson Fox and Cornet. A recent pamphlet issued by the Maryland State Department of Health, entitled "A Brief Review of the Tuberculosis Campaign, 1904–1914," shows that "in the white population beginning with the twentieth year of life all persons are equally liable to death from tuberculosis."

Chart III contains a third curve, not present in the other charts, representing the tuberculosis mortality at different decades in comparison to the total mortality from all diseases at corresponding decades.

Chart IV indicates the prevalence of tuberculosis in Pennsylvania at different ages, the mortality actually increasing in the decade seventy to seventy-nine. The figures given by Cornet indicate that for every 10,000 males between sixty and seventy years of age as many as 99.65 die of tuberculosis. German statistics frequently give a relatively higher mortality from tuberculosis among the aged than do the English figures.

Smaller divisions of the age-periods than decades will often furnish more important information. Thus we find for the registration area of the United States for pneumonia (all forms) 147.3 persons die under one year of age per 10,000 persons alive at this age, while the mortality at four years is only 6.7 per 10,000. Again, the mortality for diarrhea and enteritis under one year is 345.7 per 10,000 and at four years only 2.5 per 10,000.

Much more could be said on this subject, but I trust the one point it seemed worth while to specially emphasize has been made plain, that no figures satisfactorily express the frequency of the deaths from any disease at a given age unless they show the number of deaths from the disease for every 10,000 persons living at the same age.

CONCERNING THE PRESENCE OF TUBERCLE BACILLI IN THE BLOOD OF TUBERCULOUS PATIENTS.[1]

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The results of numerous studies of this subject during the past ten years have shown a complete lack of agreement among the various investigators. Some authors claim to have demonstrated tubercle bacilli regularly by a direct microscopic examination of the blood of tuberculous patients and frequently by the inoculation of such blood into guinea-pigs and rabbits, while other workers in this field report constantly negative results when microscopic examinations were made and few or no positive results when animal inoculations were employed. A review of the earlier work has been given by Bergeron,[2] and the more recent literature was well reviewed by Ernest Fraenkel,[3] and in this country by Berry.[4] That tubercle

[1] This work was carried out in the wards and laboratories of the Montefiore Home and Hospital for Chronic Diseases.

[2] Etude critique sur la presence du bacille de Koch dans le sang, Thèse, Paris, 1904.

[3] Schmidt's Jahrbucher, March, 1913, ccexvii, Hft. 2, 201.

[4] Tubercle Bacilli in the Blood, Jour. Inf. Dis., 1914, xiv, 162.

bacilli are at times present in the blood in acute miliary tuberculosis was demonstrated by Weichselbaum,[5] Lustig,[6] Meisel,[7] and others. The occasional presence of tubercles in the spleen, liver, kidneys, and other organs of patients who have died of chronic pulmonary tuberculosis indicates that at times tubercle bacilli gain access to the circulation. Weigert[8] emphasized the fact that pulmonary tuberculosis in contrast to acute miliary tuberculosis was not to be considered a general infection, and his views were until recently regarded as a fundamental truth in the pathology of human tuberculosis.

During the past ten years many authors have claimed, upon the basis of their investigations, that in cases of chronic pulmonary tuberculosis, tubercle bacilli are often present in the blood even in the incipient stage of the disease (Kennerknecht,[9] Kurashige,[10] Jessen and Rabinowitsch,[11] and Liebermeister,[12] while others state that they have found the organism in the blood of clinically healthy persons (Suzuki and Takaki,[13] Rumpf[14]). Kennerknecht and Kurashige insist upon the existence of a primary bacillemia in tuberculous infections.

In order to determine the presence of tubercle bacilli in the circulation, two main methods have been pursued. Those workers who have relied upon one of these—namely, the microscopic examination of the blood—have reported results varying from 0 per cent. to 100 per cent. positive findings. At first, simple blood smears or the inoscopic method of Jousset[15] were employed for microscopic examination; then the antiform and the acetic acid method of blood examination (Staubli[16]), and finally the Schnitter[17] method was

[5] Tuberkelbacillen im Blute bei allgemeiner akuter miliar Tuberkulose, Wien. med. Wochenschr., 1884, No. 12, 334.

[6] Ueber tuberkelbacillen im Blute bei an allgemeinen akuter miliar tuberkulose Erkrankten, Wien. med. Wochenschr., 1884, No. 48, 1430.

[7] Vorkommen von Tuberkelbacillen im Blute bei allgemeinen akuten miliar tuberkulose, Wien. med. Wochenschr., 1884, No. 48, 1429.

[8] Neue Mittheilungen über Pathogenie der acuten allgemeinen miliar Tuberculose, Deut. med. Wochenschr., 1883, No. 24, 349.

[9] Ueber das Vorkommen von Tuberkelbazillen im Strömenden Blut bei Kindern, Beiträge z. klin. d. Tuberkulose, 1912, xxiii, 265.

[10] Ueber das Vorkommen des Tuberkel Bacillus im Strömenden Blut der Tuberkulosen, Zeitschr. f. Tuberk., 1911, xvii, Hft. 4, 347.

[11] Ueber das Vorkommen von Tuberkelbacillen im Kreisenden Blute und die praktische Bedeutung dieser Ersheinung, Deut. med. Wochenschr., 1910, No. 24, 1116–1118.

[12] Ueber "Secundare" Tuberkulose, Med. klin., 1912, No. 25, 1018–1022.

[13] Ueber die Beziehung zwischen der von Pirquetschen Reaction und den Tuberkelbacillen im Blut, Centralbl. f. Bacterial, Orig., 1911, lxi, 149.

[14] Ueber das vorkommen von Tuberkelbacillen im Blutstrom, Münch. med. Wochenschr., 1912, No. 36, 1951.

[15] Nouvelle Methode pour isoler le bacille de Koch des bumeurs de l'organisme, La semaine médicale, 1903, No. 3, 22.

[16] Beiträge zum nachweis von Parasiten im Blut, Münch. med. Wochenschr., 1908, No. 50, 2601.

[17] Nachweis u. Bedeutung der Tuberkelbacillen im Strömenden Blut, Deut. med. Wochenschr., 1909, No. 36, 1566.

generally adopted. There have been several modifications of this last method by various investigators; all, however, are fundamentally similar. The pitfalls encountered in the microscopic methods elaborated to determine the presence of tubercle bacilli in the blood are many, and so misleading as to cast doubt upon the reliability of the positive reports by microscopic examination. Thus, distilled and tap water have been found by Beitzke[18] and Brem,[19] respectively, to contain acid-fast organisms. The stroma of red-blood corpuscles, lecithin, and cholestrin are acid-fast, and may, as Maixner[20] has shown, be mistaken for tubercle bacilli. Flakes of fibrin (Kahn)[21] and red-colored crystals (Lange and Lindemann)[22] may similarly lead to error. Anyone who has examined antiformin blood sediment stained according to the Much method for granules will, we believe, readily grant that the definite identification of tubercle bacilli is difficult and that the possibility of error is considerable; and finally it has long been known that organisms other than the tubercle bacillus, existing in our environment, may be acid-fast and that saprophytic bacteria occasionally acquire an acid-resistant power.

The other method which has been employed is that of animal inoculation, and for this purpose the guinea-pig has been the animal commonly used. That this animal is susceptible to infection with tubercle bacilli is a well-established fact, and while some investigators who claim advantages for the microscopic method have stated that the guinea-pig is not sufficiently sensitive, it has been shown by Selter[23] that ten tubercle bacilli suffice to inoculate a guinea-pig successfully, and Fraenkel and Baumann[24] think that this can be accomplished with a single organism. In order to avoid the possibility of using guinea-pigs previously inoculated with tuberculosis a preliminary tuberculin test can be made. It is probably true that all guinea-pigs are not equally susceptible to tuberculous infection (Markl),[25] and that some possess protective substances against tubercle bacilli (Kraus and Hofer);[26] but in a large series of experiments this becomes a factor of minor importance. It has been urged that the results of animal inoculation were

[18] Eine Fehlerquelle bei der Antiformin methode, Berlin. klin. Wochenschr., 1910, No. 31, 1451.

[19] Investigation of Blood for Tubercle Bacilli, Jour. Amer. Med. Assoc., 1909, liii, 909.

[20] Quoted in Zeitschr. f. Tuberculose, 1914, xxii, Hft. 3, 267.

[21] Zum Nachweis der Tuberkelbazillen im Strömenden Blut, Münch. med. Wochenschr., 1913, No. 7, 345.

[22] Ueber Tuberkelbacillen im Strömenden Blut, Centralbl. f. Bacterial. Ref., 1913, 57 Beiheft, 285.

[23] Vortag auf d. Niederrhein Ges. f. Natur u. Heilk., Bonn, July, 1913.

[24] Zeitschr. f. hyg. u. infections Krankh., 1913, lxxvi. Hft. 1.

[25] Beitrag zur Kenntnis der Nagana infection bei Meerschweischen, Centralbl. f. Bacterial, 1904, xxxvii, 530.

[26] Ueber auflösung von Tuberkelbacillen im Peritoneum gesunder u. tuberkulosen Meerschweinchen, Deut. med. Wochenschr., No. 26, 1227.

negatived by the bactericidal action of the injected blood, but Anderson[27] was able to show that this bactericidal action if present was slight by adding a small amount of emulsion of tubercle bacilli to the citrated blood from one of his cases by inoculating a guinea-pig and readily producing tuberculosis. Moreover, Moewes[28] has shown that the bacillemia present in tuberculous guinea-pigs could be demonstrated by inoculating the blood of these animals into other guinea-pigs and producing tuberculosis, and Rautenberg[29] has performed similar experiments with monkeys.

The argument has been advanced that the many negative results with animal inoculation could be traced to the treatment of the blood with antiformin before inoculation; this, it was held, destroyed the tubercle bacilli or so diminished their virulence that the inoculated animal could successfully withstand the infection.

Unlenhuth[30] has shown that a tuberculous sputum would yield positive inoculation results even after twenty-four hours' treatment with 20 per cent. antiformin, and Seemann[31] demonstrated that a 15 per cent. antiformin solution could not kill the tubercle bacilli in one hour. In view of these experiments, and considering the fact that, under ordinary circumstances, a clear solution is obtained by the antiformin method in twenty minutes to half an hour, it is unlikely that this method influences the virulence of the tubercle bacilli.

Our experiments were undertaken with the hope of determining whether a bacillemia existed in patients suffering from chronic pulmonary tuberculosis, and at the same time to confirm or disprove the value of the methods recently advocated for this purpose.

The methods which we pursued were as follows:

1. The blood taken from patients with advanced pulmonary tuberculosis was inoculated directly into the peritoneal cavities of guinea-pigs.

2. The blood from some of these patients was treated and examined microscopically.

3. The blood from tuberculous patients who had previously received an injection of tuberculin was inoculated intraperitoneally into guinea-pigs.

4. The blood was withdrawn from tuberculous patients who had previously received a tuberculin injection, and after removal of the serum intraperitoneal injections were made into guinea-pigs.

[27] Bull. No. 57 Public Health and Marine Hospital Service of the United States, September, 1909.

[28] Tuberkelbacillen im Blute, Deut. med. Wochenschr., 1914, No. 10, 491.

[29] Zur Frage der Bacillaemie bei Tuberkulose, Deut. med. Wochenschr., 1914, No. 10, 492.

[30] Antiformin, Ein Bacterienauflösen des Desinfectionsmittel, Zentralbl. f. Bakt., 1908–1909, Abt. 1, Referate, xlii, 62.

[31] Die Braubarkeit des antiformins zum Nachweis von Tuberkelbacillen, Berl. klin. Wochenschr., 1909, No. 14. 628.

5. The blood, after removal of the serum, was planted upon culture tubes of gentian-violet media.

The technique pursued was as follows:

Method 1. With aseptic precautions 5 c.c. of blood were withdrawn from a vein at the elbow into a syringe. The blood was immediately injected into the peritoneal cavity of a guinea-pig whose ventral surface had previously been shaved and treated with iodin. This direct and rapid transferrence of blood rendered the use of citrated solutions unnecessary; intraperitoneal injections were made because this route had yielded satisfactory results in the hands of other investigators. Blood withdrawn from thirty-eight patients was examined by this method. Tubercle bacilli were found in the sputum of thirty-seven of them, and in the remaining patient definite bilateral pulmonary signs were present. The patients were classified according to the classification adopted by the Association for the Study and Prevention of Tuberculosis. One patient was in stage I, seven patients were in stage II, and thirty were in stage III, and of the last mentioned, many were acutely ill with high fever, chills, sweats, and the clinical manifestations of cavitation.

Of 38 guinea-pigs inoculated in the manner described above, 2 died forty-seven days, 1 fifty-eight days, 1 sixty-six, and 1 eighty-three days following the injection, and were autopsied. The remaining 33 animals were chloroformed at periods varying from sixty-three to one hundred and twenty-nine days following the inoculation. Careful autopsies were also performed upon each of these animals, and material was taken from the lungs, liver, spleen, and kidneys for microscopic examination.

The autopsies and microscopic examination failed to reveal the slightest evidence of tuberculosis in the inoculated guinea-pigs. In none of the animals was there any enlargement of either the mesenteric or retroperitoneal lymph glands, so that the occurrence of a mild tuberculous infection from which the guinea-pig recovered cannot here be considered as evenly remotely possible.

Method 2. The blood of ten patients (Nos. 19, 20, 21, 22, 23, 24, 31, 32, 33, 34) in whom the disease was far advanced was withdrawn for microscopic examination. The method of treating the blood was exactly the same as that employed and advocated by Klemperer,[32] and by which he had obtained positive results. Five c.c. of blood were withdrawn with aseptic precautions by a sterilized syringe which had been washed with distilled water. The blood was then transferred to a vessel which had been cleaned with soap suds, alcohol, and ether, cotton plugged and sterilized at 180° to 200° F. for one hour. To this 5 c.c. of blood, 10 c.c. of 3 per cent. acetic acid, prepared with distilled water, were added,

[32] Tuberclebacillen im Blut, Zeitschr. f. klin. Med., 1914, clxxx, Hft. H. 2.

the vessel being carefully shaken, without producing foam and then allowed to stand half an hour. This solution was poured into two centrifuge tubes, which had been cleaned in a similar fashion to the first used vessel, and were passed through a flame just before being used, and centrifuged for half an hour. The supernatant fluid was taken off and five times the quantity of 33 per cent. antiformin added. The centrifuge tubes were closed with sterile rubber corks and shaken until the fluid became clear. Then the tubes were filled with double distilled water and centrifuged for one hour (2500 revolutions to the minute). A small white sediment remained; the supernatant fluid was removed, the sediment washed with double distilled water, and centrifuged for one and a quarter hours. This washing and centrifugalization were repeated four times. The sediment from each tube was finally poured onto two new slides. The slides had been washed in alcohol and sterilized at 250° F. for one hour and glowed over a Bunsen flame just before use. This preparation was placed in a sterile Petri dish and dried in an oven, and finally stained with a freshly prepared Ziehl-Nielsen stain. The stain was made up with distilled water. A careful systematic search was then made of the blood which had finally been deposited upon the two slides. At least four hours were devoted to the examination of each one of the slides from these ten cases. Not a single tubercle bacillus was found.

The negative results obtained with methods 1 and 2 induced us to attempt method 3, which concerns itself with the inoculation into guinea-pigs of blood from patients who had some hours previously received an injection of tuberculin. Such an injection of tuberculin has been followed, it has been stated, and then again denied, by a mobilization of tubercle bacilli in the circulation.

Bacmeister[33] inoculated the blood of fifteen patients, who had previously received a diagnostic tuberculin injection, into rabbits and produced tuberculosis in four instances. Mayer[34] studied sixteen tuberculous patients who had received tuberculin injections, but the blood from these patients inoculated into guinea-pigs failed to produce tuberculosis, while Liebermeister[35] obtained positive inoculation results after a tuberculin injection where these had previously been negative. The latter has also seen a previously positive inoculation yield negative results following a tuberculin injection; he doubts whether tuberculin in the usually employed dosage can cause a mobilization of tubercle bacilli.

Rabinowitsch and Moewes[36] found more positive inoculation results in tuberculous guinea-pigs after a tuberculin injection than

[33] Des auftreten virulenter Tuberkelbacillen im Blut nach der diagnostischen Tuberculin Injection, Münch med. Wochenschr., 1913, No. 7, 343.

[34] Ueber das Vorkommen von Tuberkelbazillen im Strömenden Blut u. in der menschlichen Milch, Z. f. schr. f. Tuberculose, 1913, xxi, Hft. 5.

[35] Sitzungsber. d. neiderrh. Gesells. f. Natur u. Heilk, Bonn, January 20, 1914.

[36] Sitzung. der Berliner med. Gesellsch., February, 1914.

before, while Hage[37] failed to obtain positive inoculation results in tuberculous guinea-pigs regardless of how irregularly or systematically the tuberculin had been administered.

Method 3. Seven patients (Nos. 36, 37, 38, 39, 40, 41, and 42), of whom five were in the third stage and two were in the second stage of the illness, were subjected to a tuberculin injection; 0.1 milligram or 0.2 milligram of Koch's therapeutic tuberculin was injected subcutaneously; seven hours later 5 c.c. of blood were withdrawn for direct inoculation into the perioneal cavity of a guinea-pig. Of these seven guinea-pigs, one died on the thirty-eighth day following inoculation and was autopsied, while the others were chloroformed at periods ranging from sixty-seven to ninety-one days. After the inoculation, careful autopsies were performed and material taken from the various organs for microscopic examination. No evidence of tuberculosis was revealed by any of these sections.

Method 4. Three patients (Nos. 45, 46, and 47), of whom two were in stage III and one in stage II of the disease, were each injected with 0.2 milligram of Koch's therapeutic tuberculin. Seven hours later 5 c.c. of blood were withrawn from each patient. In order to exclude the possible presence of any protective substances the serum was removed from this blood by centrifugalization and 0.5 per cent. sterile acetic acid added to the blood. The centrifuge tube was then closed with a sterile rubber cork, thoroughly shaken, and centrifuged. The resulting sediment was injected intraperitoneally into a guinea-pig. These three pigs were chloroformed seventy-four days after inoculation. Careful autopsies were performed and material taken from the various organs for microscopic examination. Of these three inoculations one (Case 45) yielded a positive result and extensive tuberculosis of the lungs, liver, spleen, and lymph glands were found.[38]

Method 5. From each of five far-advanced cases 5 c.c. of blood were withdrawn, centrifuged, and the supernatant serum removed. The sediment was then treated with 0.5 per cent. sterile acetic acid and centrifuged. The resulting sediment was implanted upon ten culture tubes of gential violet. No growth was obtained at the end of two weeks, on any of the tubes.[39]

SUMMARY. A number of different methods have been employed by us to determine whether tubercle bacilli are present in the circulation of patients with advanced pulmonary tuberculosis.

[37] Ueber das Vorkommen von Tuberkelbacillen im Strömenden Blut beim tuberkulosen u. tuberkulinsierten meerschweinschen, Beitr. z. klin. d. Tuberk., 1914, xxxi, Hft. 1, 71.

[38] Further experiments along these lines are now in progress and will be the subject of a later report.

[39] I am indebted to Mr. Pertroff, of the laboratory at the Adirondack Cottage Sanitarium, for giving me the gentian-violet media.

1. Blood withdrawn from thirty-eight patients was inoculated intraperitoneally into guinea-pigs. Autopsies and microscopic sections two to three months later failed to reveal any evidence of tuberculosis.

2. Microscopic examination of the blood withdrawn from ten patients yielded negative results. The many sources of error in the microscopic examination of blood for tubercle bacilli have been pointed out.

3. The blood of seven patients previously subjected to a tuberculin injection was inoculated intraperitoneally into guinea-pigs. Autopsies and microscopic sections failed to reveal any evidence of tuberculosis.

4. In three patients who had previously received a tuberculin injection, blood was withdrawn and after removal of the serum was inoculated intraperitoneally into guinea-pigs. One of the pigs developed an extensive tuberculosis.

5. An attempt made to grow the tubercle bacilli directly from the blood proved unsuccessful.

Discussion. The negative results yielded by these forty-seven cases do not prove conclusively that tubercle bacilli are never present in the circulation, but they strongly suggest that a bacillemia such as is present in other infectious diseases is at least uncommon in pulmonary tuberculosis even in advanced stages of the disease. It may be that from time to time tubercle bacilli are washed into the circulation from a pulmonary focus, and that they rapidly disappear from the blood. That such a rapid departure from the blood does occur, has been demonstrtaed in the case of rabbits in whom tubercle bacilli could no longer be recovered from the blood thirty minutes after their intravenous inoculation (Heymann and Otto).[40]

When the blood of ten patients previously subjected to a tuberculin injection was inoculated into guinea-pigs, one of the animals presented a generalized tuberculosis at autopsy. It would be unwise to draw conclusions from one positive result, but the nine negative results coincide with our daily clinical experience, for if a therapeutic tuberculin injection could cause virulent tubercle bacilli to appear in the circulation the development of acute miliary tuberculosis would be a common occurrence. Nevertheless, the question of a possible mobilization of tubercle bacilli following diagnostic and therapeutic tuberculin inoculations deserves careful investigation.

I wish to take this opportunity to express thanks to the house staff and Dr. Felberbaum of the laboratory for willing aid in carrying out this work.

[40] Centralbl. f. bacterial Ref., 1913, lvii, 293.

CASE REPORTS.

CASE 1.—Stage II. Temperature ranged between 98.6° and 101.4° F. March 27, 1914: temperature, 100.4° F.; 5 c.c. of blood injected into guinea-pig No. 74.

The pig was chloroformed July 21, 1914, one hundred and sixteen days following inoculation. No gross evidence of tuberculosis; no enlargement of mesenteric or retroperitoneal glands; microscopically, no evidence of tuberculosis.

CASE 2.—Stage III. Temperature ranged between 96° and 102.4° F. March 31, 1914: temperature, 99° F.; 5 c.c. of blood injected into guinea-pig No. 2.

The pig was chloroformed August 7, 1914, one hundred and twenty-nine days after inoculation. No macroscopic evidences of tuberculosis; retroperitoneal and mesenteric glands were not enlarged; microscopically no evidences of tuberculosis.

CASE 3.—Stage III. Temperature ranged between 98° and 104° F. April 7, 1914: temperature, 103.6° F.; 5 c.c. of blood injected into guinea-pig No. 18.

The pig was chloroformed July 24, 1914, one hundred and one days after inoculation. No macroscopic evidences of tuberculosis; microscopically all of the organs appear normal; no enlargement of mesenteric or retroperitoneal glands.

CASE 4.—Stage III. Temperature ranged between 97.6° to 103.4° F. April 10, 1914: temperature, 100.4° F.; 5 c.c. of blood injected into guinea-pig No. 11.

The pig was chloroformed August 7, 1914, one hundred and nineteen days after inoculation. There were a number of adhesions between the stomach and liver; no evidences of tuberculosis, either grossly or microscopically.

CASE 5.—Stage I. Temperature ranged between 98.2° and 101° F. April 24, 1914: temperature, 100.2° F.; 3 c.c. of blood injected into guinea-pig No. 4.

The pig was chloroformed August 7, 1914, one hundred and five days after inoculation. There are marked adhesions between the spleen and the stomach, also a few adhesions between the parietal peritoneum and intestines; no enlargement of mesenteric or retroperitoneal glands; no gross or microscopic evidences of tuberculosis in any organ.

CASE 6.—Stage II. Temperature ranged between 98.8° and 100.4° F. April 24, 1914: 5 c.c. of blood injected into guinea-pig No. 5.

The pig was chloroformed August 7, 1914, one hundred and five days after inoculation. No evidences of tuberculosis, either grossly or microscopically; no enlargement of mesenteric or retroperitoneal glands.

CASE 7.—Stage III. Temperature ranged between 98° and 101° F. April 28, 1914: 5 c.c. of blood injected into guinea-pig No. 6.

The pig died June 25, 1914, fifty-eight days following inoculation. No evidence of tuberculosis in any organ, either grossly or microscopically; retroperitoneal or mesenteric glands were not enlarged.

CASE 8.—Stage III. Temperature ranged between 97° and 103° F. April 28, 1914: temperature, 100.2° F.; 5 c.c. of blood injected into guinea-pig No. 9.

The pig was chloroformed August 7, 1914, one hundred and one days after inoculation. No evidence of tuberculosis in any organ, either grossly or microscopically; congestion of spleen.

CASE 9.—Stage III. Temperature ranged between 97° and 99.2° F. April 28, 1914: temperature, 98.6° F.; 5 c.c. of blood injected into guinea-pig No. 8.

The pig was chloroformed August 7, 1914, one hundred and one days after inoculation. No evidence of tuberculosis in any organ, either grossly or microscopically; no enlargement of mesenteric or retroperitoneal lymph glands.

CASE 10.—Stage III. Temperature ranged between 98° and 100° F. April 28, 1914: temperature, 98.8° F.; 5 c.c. of blood injected into guinea-pig No. 7.

The pig was chloroformed August 7, 1914, one hundred and ninety-one days after inoculation. Some adhesive peritonitis present between liver, stomach, and intestines; moderate perisplenitis; no enlargement of mesenteric or retroperitoneal glands. Microscopically all organs negative for tuberculosis.

CASE 11.—Stage III. Temperature ranged between 97° and 101° F. May 5, 1914: temperature, 100.4° F.; 5 c.c. of blood injected into guinea-pig No. 12.

The pig was chloroformed August 7, 1914, ninety-four days after inoculation. No evidence of tuberculosis in any organ either grossly or microscopically; mesenteric and retroperitoneal glands not enlarged.

CASE 12.—Stage II. Temperature ranged between 98.4° and 102° F. May 5, 1914: temperature, 100.4° F.; 5 c.c. of blood injected into guinea-pig No. 10.

The pig was chloroformed August 7, 1914, ninety-four days after inoculation. Congestion of lungs, otherwise organs negative; no enlargement of mesenteric or retroperitoneal lymph glands. Microscopically no evidences of tuberculosis.

CASE 13.—Stage III. Temperature ranged between 98° and 101.4° F. May 5, 1914: temperature, 99.4° F.; 5 c.c. of blood injected into guinea-pig No. 11.

The pig was chloroformed August 7, 1914, ninety-four days after inoculation. No gross changes found; no enlargement of

mesenteric or retroperitoneal lymph glands. Microscopically no evidence of tuberculosis.

CASE 14.—Stage II.—Temperature ranged between 98° and 101° F. May 5, 1914: 5 c.c. of blood injected into guinea-pig No. 85.

The pig was chloroformed August 11, 1914, ninety-eight days after inoculation. Spleen somewhat enlarged, otherwise organs appear normal; no enlargement of mesenteric or retroperitoneal lymph glands. Microscopically no evidences of tuberculosis in any organ.

CASE 15.—Stage III. Temperature ranged between 97.8° and 100° F. May 6, 1914: temperature, 99.6° F.; 5 c.c. of blood injected into guinea-pig No. 56.

The pig was chloroformed August 11, 1914, ninety-seven days after inoculation. No gross or microscopic evidence of tuberculosis; no enlargement of mesenteric or retroperitoneal glands.

CASE 16.—Stage II. Temperature ranged between 97° and 101.4° F. May 6, 1914: temperature, 98.2° F.; 5 c.c. of blood injected into guinea-pig No. 15.

The pig was chloroformed August 11, 1914, ninety-seven days after inoculation. Spleen not enlarged, a grayish nodule on the surface microscopically shown to be inflammatory in character, other organs negative for tuberculosis, grossly and microscopically; no enlargement of peritoneal lymph glands.

CASE 17.—Stage II. Temperature ranged between 98° and 100.2° F. May 6, 1914: temperature, 99° F.; 5 c.c. of blood injected into guinea-pig No. 16.

The pig died July 28, 1914, eighty-three days after inoculation. Extensive ulceration of back. No evidence of tuberculosis upon gross or microscopic examination; no enlargement of mesenteric or retroperitoneal lymph glands.

CASE 18.—Stage III. Temperature ranged between 97° and 101.2° F. May 6, 1914: temperature, 100° F.; 5 c.c. of blood injected into guinea-pig No. 17.

The pig was chloroformed August 11, 1914, ninety-seven days after inoculation. No evidence of tuberculosis upon gross or microscopic examination; no enlargement of mesenteric or retroperitoneal lymph glands.

CASE 19.—Stage III. Temperature ranged between 97.2° and 102° F. June 5, 1914: temperature, 100.2° F.; 5 c.c. of blood injected into guinea-pig No. 58.

The pig was chloroformed August 11, 1914, sixty-seven days after inoculation. No gross or microscopic evidence of tuberculosis in any organ; no enlargement of mesenteric or retroperitoneal lymph glands.

CASE 20.—Stage III. Temperature ranged between 97.4° and 102° F. June 6, 1914: temperature, 101° F.; 5 c.c. of blood injected into guinea-pig No. 57.

The pig was chloroformed August 11, 1914, sixty-six days after inoculation. No evidence of tuberculosis upon gross or microscopic examination; no enlargement of mesenteric or retroperitoneal glands.

Case 21.—Stage III. Temperature ranged between 97° and 103.8° F. June 8, 1914: temperature, 100° F.; 5 c.c. of blood injected into guinea-pig No. 59.

The pig was chloroformed August 11, 1914, sixty-four days after inoculation. The spleen is very small and is adherent to stomach; no gross or microscopic evidence of tuberculosis; no enlargement of retroperitoneal or mesenteric glands.

Case 22.—Stage III. Temperature ranged between 97° and 102.4° F. June 8, 1914: temperature, 100.4° F.; 5 c.c. of blood injected into guinea-pig No. 84.

The pig was chloroformed August 11, 1914, sixty-four days after inoculation. No gross or microscopic evidence of tuberculosis; no enlargement of mesenteric or retroperitoneal lymph glands.

Case 23.—Stage III. Temperature ranged between 97° and 100.8° F. June 9, 1914: temperature, 100.2° F.; 5 c.c. of blood injected into guinea-pig No. 61.

The pig died August 14, 1914, three days after delivery; sixty-six days after injection. Congestion of lungs, purulent peritonitis, cloudy swelling of viscera; no evidence of tuberculosis in any organ; no enlargement of mesenteric or retroperitoneal lymph glands. Microscopic examination negative for tuberculosis.

Case 24.—Stage III. Temperature ranged between 97.4° and 100.6° F. June 9, 1914: temperature, 98° F.; 5 c.c. of blood injected into guinea-pig No. 62.

The pig was chloroformed August 11, 1914, sixty-three days after inoculation. Spleen slightly enlarged; no evidence of tuberculosis in any organ upon microscopic examination; no enlargement of mesenteric or retroperitoneal lymph glands.

Case 25.—Stage III. Temperature ranged between 98° and 101° F. June 9, 1914: temperature, 99.6° F.; 5 c.c. of blood injected into guinea-pig No. 64.

The pig was chloroformed August 15, 1914, sixty-seven days after inoculation. Spleen very much enlarged, weighs 5 grams; no gross evidence of tuberculosis; no enlargement of mesenteric or retroperitoneal lymph glands. Microscopically organs appear normal.

Case 26.—Stage III. Temperature ranged between 98° and 102.4° F. June 9, 1914: temperature, 100.2 F.; 5 c.c. of blood injected into guinea-pig No. 65.

The pig died July 26, 1914, forty-seven days after inoculation. Purulent pericarditis; purulent inflammation of left lung; pneumonia in right lung; cloudy swelling of other viscera. Microscopically no evidence of tuberculosis.

CASE 27.—Stage III. Temperature ranged between 97.6° and 100.6° F. June 10, 1914: 5 c.c. of blood injected into guinea-pig No. 66.

The pig was chloroformed August 15, 1914, sixty-six days after inoculation. No gross or microscopic evidence of tuberculosis; no enlargement of mesenteric or retroperitoneal lymph glands.

CASE 28.—Stage III. Temperature ranged between 97.6° and 102° F. June 9, 1914: temperature, 99.6° F.; 5 c.c. of blood injected into guinea-pig No. 67.

The pig died July 26, 1914, forty-seven days after inoculation. Patches of bronchopneumonia in left lung; purulent peritonitis; cloudy swelling of liver, spleen, and kidneys. Microscopically no evidences of tuberculosis.

CASE 29.—Stage III. Temperature ranged between 97° and 102° F. June 9, 1914: temperature, 100° F.; 5 c.c. of blood injected into guinea-pig No. 68.

August 15, 1914, sixty-seven days after inoculation, the pig was etherized. No evidence of tuberculosis upon gross examination. Microscopically the organs were normal.

CASE 30.—Stage III. Temperature ranged between 98° and 102.8° F. June 10, 1914: temperature, 100.8° F.; 5 c.c. of blood injected into guinea-pig No. 63.

The pig was etherized August 15, 1914, sixty-six days after inoculation. Few peritoneal adhesions, no glandular enlargement. Microscopically no evidence of tuberculosis.

CASE 31.—Stage III. Temperature ranged between 97.4° and 102° F. June 11, 1914: temperature, 99.4° F., 5 c.c. of blood injected into guinea-pig No. 69.

The pig was etherized August 15, 1914, sixty-five days after inoculation. No gross or microscopic evidence of tuberculosis; no enlargement of retroperitoneal or mesenteric lymph glands.

CASE 32.—Stage III. Temperature ranged between 97° and 102.4° F. June 11, 1914: temperature, 101° F.; 5 c.c. of blood injected into guinea-pig No. 70.

The pig was etherized August 15, 1914, sixty-five days after inoculation. No gross or microscopic evidence of tuberculosis; no enlargement of mesenteric or retroperitoneal lymph glands.

CASE 33.—Stage III. Temperature ranged between 97° and 103.6° F. June 12, 1914: temperature 102° F.; 5 c.c. of blood injected into guinea-pig No. 71.

The pig died August 8, 1914, fifty-seven days after inoculation. Small cyst at lower pole of right kidney, otherwise negative; no enlargement of mesenteric or retroperitoneal lymph glands. Microscopically, negative.

CASE 34.—Stage III. Temperature ranged between 97.4° and 102° F. June 12, 1914: temperature, 99.4° F.; 5 c.c. of blood injected into guinea-pig No. 72.

August 15, 1914, the pig was etherized, sixty-four days after inoculation. No gross or microscopic evidence of tuberculosis.

CASE 35.—Stage II. Temperature ranged between 97° and 100° F. June 12, 1914: temperature, 98.8° F.; 5 c.c. of blood injected into guinea-pig No. 73.

August 15, 1914, the pig was etherized, sixty-four days after inoculation. No gross evidence of tuberculosis. Microscopically the organs were normal.

CASE 36.—Stage II. Temperature ranged between 97° and 101.6° F. June 19, 1914: Koch's therapeutic tuberculin 0.1 mgm. injected at 9 A.M. Temperature, 100.2° F.; 4.5 c.c. of blood injected into guinea-pig No. 75 at 4 P.M.

The pig was chloroformed September 18, 1914, ninety-one days after inoculation. No evidence of tuberculosis; mesenteric and retroperitoneal glands are not enlarged. Microscopically negative for tuberculosis.

CASE 37.—Stage III. Temperature ranged between 97° and 100° F. June 19, 1914: Koch's therapeutic tuberculin 0.1 mgm. injected at 9 A.M. Temperature, 99.2° F.; 2.5 c.c. of blood injected into guinea-pig No. 76 at 4 P.M.

The pig was chloroformed September 18, 1914, ninety-one days after inoculation. No evidence of tuberculosis; no enlargement of mesenteric or retroperitoneal lymph glands. Microscopically all the organs were normal.

CASE 38.—Stage III. Temperature ranged between 97° and 100° F. June 19, 1914: Koch's therapeutic tuberculin 0.1 mgm. injected at 9 A.M. Temperature, 99.2° F.; 5 c.c. of blood injected into guinea-pig No. 77 at 4 P.M.

The pig was chloroformed September 18, 1914, ninety-one days after inoculation. A few adhesions found between intestine and liver; spleen embedded in a mass of adhesions. Microscopically negative for tuberculosis.

CASE 39.—Stage III. Temperature ranged between 97° and 100.4° F. June 23, 1914: Koch's therapeutic tuberculin 0.2 mgm. injected at 9 A.M. Temperature, 100.4° F.; 5 c.c. of blood injected into guinea-pig No. 81 at 4 P.M.

The pig was chloroformed September 18, 1914, eighty-seven days after inoculation. No gross evidences of tuberculosis; no enlargement of mesenteric or retroperitoneal lymph glands. Microscopically organs are negative.

CASE 40.—Stage II. Temperature ranged between 98° and 101.8° F. July 7, 1914: Koch's therapeutic tuberculin 0.2 mgm. injected at 9 A.M. Temperature, 101° F.; 5 c.c. of blood injected into guinea-pig No. 78 at 4 P.M.

The pig was chloroformed September 18, 1914, seventy-three days after inoculation. No gross evidence of tuberculosis; no enlargement of mesenteric or retroperitoneal lymph glands. Microscopically all the organs are negative.

CASE 41.—Stage III. Temperature ranged between 98° and 100.4° F. July 13, 1914: Koch's therapeutic tuberculin 0.2 mg. injected at 9 A.M.; 5 c.c. of blood injected into guinea-pig No. 79 at 4 P.M.

The pig died August 20, 1914, thirty-eight days after inoculation. No gross evidence of tuberculosis; no enlargement of mesenteric or retroperitoneal lymph glands. Microscopically all the organs are negative.

CASE 42.—Stage III. Temperature ranged between 98° and 100.6° F. July 13, 1914: Koch's therapeutic tuberculin 0.1 mg. injected at 9 A.M. Temperature, 99.6° F.; 5 c.c. of blood injected into guinea-pig No. 82 at 4 P.M.

The pig was chloroformed September 18, 1914, sixty-seven days after inoculation. No gross evidence of tuberculosis; no enlargement of mesenteric or retroperitoneal lymph glands. Microscopically all the organs are negative.

CASE 43.—Stage III. Temperature ranged between 98° and 104° F. July 21, 1914: temperature, 103° F.; 2.5 c.c. of blood injected into guinea-pig No. 83.

The pig was chloroformed September 18, 1914, fifty-nine days following inoculation. No gross evidence of tuberculosis; no glandular enlargement. Microscopically all the organs are negative.

CASE 44.—Stage III. Temperature ranged between 97° and 102° F. July 28, 1914: temperature, 99.2° F.; 4 c.c. of blood injected into guinea-pig No. 86.

October 13, 1914, seventy-seven days following inoculation, the pig was chloroformed; no microscopic evidence of tuberculosis; no enlargement of mesenteric or retroperitoneal lymph glands. Microscopically the organs are negative.

CASE 45.—Stage II. August 1, 1914, 0.2 mg. of Koch's therapeutic tuberculin injected at 9 A.M. Temperature, 100.4° F.; seven hours after injection of tuberculin, 5 c.c. of blood withdrawn. Blood treated as described in text. Sediment injected into guinea-pig No. 89.

October 13, 1914 the pig was chloroformed, seventy-four days following inoculation. Tuberculosis of lungs, liver, spleen, and lymph glands. December 8: no apparent change in clinical condition of patient. No temperature changes followed above experiment.

CASE 46.—Stage III. Temperature ranged between 97° and 101.6° F. August 1, 1914, seven hours after injection of 0.2 mg. of Koch's therapeutic tuberculin, temperature, 99.4° F.; 5 c.c. of blood injected into guinea-pig No. 88. Blood treated as in Case 45.

The pig was chloroformed October 13, 1914, seventy-four days after inoculation. No gross evidence of tuberculosis. Microscopically all organs are negative.

Case 47.—Stage III. Temperature ranged between 99° and 100.4° F. August 1, 1914, seven hours after inoculation with 0.2 mg. of Koch's therapeutic tuberculin, 5 c.c. of blood taken from patient and injected into guinea-pig No. 90. Blood treated as in Cases 45 and 46.

The pig was chloroformed October 13, 1914, seventy-four days after inoculation. No macroscopic evidence of tuberculosis; no enlargement of mesenteric or retroperitoneal lymph glands. Microscopically all the organs are negative.

Case 48.—Stage III. Temperature ranged between 97° and 102.4° F. June 8, 1914: temperature, 100.4° F.; 5 c.c. of blood injected into guinea-pig No. 60.

The pig was chloroformed September 18, 1914, one hundred and two days after inoculation. No gross evidence of tuberculosis; no enlargement of mesenteric or retroperitoneal lymph glands. Microscopically no evidence of tuberculosis found.

PRURIGO NODULARIS AND LICHENIFICATION WITH TUMOR FORMATION.

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One of the cases about to be described is from the service of Dr. Trimble, at the University and Bellevue Dermatological Clinic, and to him I am indebted for the privilege of recording it; the other is from the out-patient department of the Roosevelt Hospital. The case histories follow:

Case I.—Mr. G. S., aged seventy-three years, a shoemaker, born in Germany. For the past eleven years he has suffered from moderate dyspnea on exertion, and he often has a cough in the early winter, but this is not serious. His bowels are regular, but sweet food is apt to start a mild diarrhea. He seldom suffers from headache. His general health was good until the spring of 1910, when he was taken sick rather suddenly with increased frequency of micturition, pain across the back, especially on the left side, which was tender to the touch, and stiffness of the muscles of the back. He was in bed for five weeks, and was told that he had kidney and stomach disease. There has been no return of these symptoms, but he has never been as well since, and is sleepy and tired most of the time.

Itching of the skin began immediately after this attack, and was and is generalized. Papules have been present from the start, and at no time has the skin been free of the eruption; indeed, the patient cannot be sure of any period of improvement. There has never been any exudation, although the skin is often scratched until blood flows.

The eruption involves the greater part of the trunk and extremities. On the back it extends over the whole lumbar region, with an extension upward on the right to the middle of the shoulder

FIG. 1.—Lichenification with tumor formation. Mr. G. S.

blade, and on the left, along the posterior axillary fold, nearly to the axilla. These upward extensions show only a slight drying and thickening of the skin, with a few scratched papules and slight pigmentation.

The skin over the pubes is dry and thick, the process extending along the linea alba to the navel. The skin in the folds of the groin is thickened and purplish.

The lower extremities are affected in their entirety, except for the upper antero-internal surface of the thighs, an area about three inches in diameter over each trochanter, and the soles of the feet.

The upper extremities are less involved, the eruption being

confined to the external and the posterior radial surfaces of the forearms.

The affected surface is dry and harsh. The smallest lesions are only slight exaggerations of the normal cross-hatching of the skin. Next come small papules, which seem to be thickenings of the deeper layers of the skin, the horny layer being but little affected. The smallest lesions are shiny and flat-topped; the next larger ones are rounded and not particularly shiny. The color of the earliest lesions and of those of the second class also is that of the normal skin, except that in patches of long standing their color is that of the surrounding skin—a dull purple. The larger papular lesions are all scratched, as are also most of the others. Some of the papules seem to be receding; on the forearms are many white spots of thickened skin, which appear to be the remains of former lesions. The greatest thickening and the greatest number of papules occur on the lower legs, where the eruption first developed. The forearms show no large papules, and few occur on the back. The general effect is one of extending and increasing lichenification, with firm papules or nodules arising from the middle of the lichenified areas. The nodules appear to be localized exaggerations of a general process rather than a separate condition.

No urticarial or erythematous lesions were observed. Treatment was practically without effect.

Case II.—Miss S. O., a Swede, aged twenty-five years, employed in the linen room of a New York hotel, applied for treatment at the out-patient department of Roosevelt Hospital in December, 1913. There is no tuberculosis in her family and no skin disease like hers. Her father is alive at sixty-three, and is alcoholic; her mother is about fifty-five years old, and healthy. The patient states that she has had measles and whooping cough, but not scarlet fever. She has always been constipated. She says that she had chills and fever every day for two years until she was seventeen years old. She has never been subject to hives. Her hair has always been thin, and her skin coarse and harsh, but it does not chap severely. On the other hand, her skin blisters easily from moderate heat, and develops callosities rather readily. She states that in August, 1911, a papule appeared on her left forearm, perhaps from an insect bite; this she scratched. Two weeks later a boil developed at the site of the original papule, and from that time until the end of the year a series of boils occurred on both forearms. During this time she noticed that on coming into a warm room from the cold air outside there appeared on the hand and ankles a number of small firm nodules, which burned and itched badly. The color was that of the normal skin or a little darker, but not red.

She was admitted to the New York Skin and Cancer Hospital in November, 1911, her hands being then so badly crippled by boils that she could hardly use them. She remained in the hospital

about four months, and in that time the boils were healed and have not returned, but the nodules were unchanged.

New nodules have appeared from time to time, the eruption gradually creeping up the extremities toward the trunk. The patient states that after severe scratching and removing the thickened, horny layer, which brings with it a horny plug or kernel, the itching subsides and the papules flatten down to a slight thickening in the skin, but that they never disappear entirely, and increase in size again when irritated. She states that irritation of an old flattened lesion will often produce a blister containing bloody serum. She insists that the papules appear first and increase under scratching, but that scratching of healthy skin is not followed by the development of a papule. The itching, which appears to be limited to the lesions, is very severe, and often interferes with sleep. It is worse whenever the patient is more than usually nervous and whenever her mind is not distracted by her occupation. It is also worse the first day or two of the menses, but there is no increase in the size of the lesions at that time.

For the past year or two the patient has often been sleepy in the afternoon, and her legs have ached badly after slight exertion, like going up stairs. Headaches were infrequent until the summer of 1913, since which time they have been quite common; and more recently she has been subject to attacks of overpowering sleepiness, lasting ten to fifteen minutes, and then passing off suddenly. All these constitutional symptoms are relieved or removed by careful attention to the bowels.

When examined by me, December 16, 1913, the skin of the face was rough, coarse, and muddy looking, but no distinct tumors were made out. The tongue showed upon the right side of the dorsal surface a white sclerotic area dotted with a few red spots, about a quarter of an inch broad and an inch long, the anterior extremity being about three-quarters of an inch from the tip of the tongue. This area is depressed slightly below the level of the adjoining mucous membrane, but is not ulcerated. The patient says that it has grown from a spot about the size of a pea in the past year or less. A later examination revealed a firm white nodule about a quarter of an inch in diameter on the right side of the bottom of the tongue just below this white plaque. It was not so hard as to suggest cancer, and gave one the impression that it was produced by the same process which had caused the tumors in the skin.

The characteristic nodules were scattered over both upper and lower extremities. There was no tendency to grouping, and flexor and extensor surfaces were involved alike. Two papules were found on the left thenar eminence, and one on the right palm; otherwise the palms were free. Forty-four lesions of all sizes were counted on the back of the right hand and fingers, and fifty-five on the left, and they were almost as thickly scattered over both

forearms and legs. There were a few papules on the arms and one small one on the left side of the neck. On the back of the neck, about an inch to the right of the middle line and just below the hair, there was a papule about three-sixteenths of an inch in diameter, exactly like the others, which is said to have appeared after the removal of a growth of unknown nature from the same spot eight or nine years ago. The earliest lesions appeared to be small nodules in or under the skin, the epithelium above them unchanged. In the older lesions the epithelium was thickened, pink or light brownish in color, and generally slightly rough and warty, but without any papillary projection or deep depressions. The lesions on the upper part of the arms, where the disease seemed to be spreading, were, as a rule, small, about one-eighth of an inch in diameter, and showed but little elevation. Some were scarcely perceptible, while the largest tumors on the hands were three-

FIG. 2.—Prurigo nodularis. Miss S. O.

eighths of an inch in diameter, and on the legs, seven-sixteenths of an inch. Many of the medium-sized and large lesions were capped by a brownish crust. The removal of the thickened epithelium from the medium-sized tumors revealed a shallow crater, the concavity of which was studded with many fine bleeding points. Crusts removed from the tops of some of the older lesions showed filiform horny plugs about a sixteenth of an inch long projecting from the under surface.

An area on the forearm, about an inch and a half in diameter, entirely free of the eruption, was enclosed in a line drawn with silver nitrate. The reaction to the caustic was unusually severe. A painful blister formed where the line had been, and when this ruptured and dried, a red line was left, which remained for weeks. The patient was instructed to scratch this enclosed area repeatedly, and this she assures me she has done, but no sign of tumor formation has appeared.

The Wassermann reaction and the Morro tuberculin reaction were both negative.

On February 6, 1914, the patient came to me to show a group of ecchymoses, covering an area about two inches by four inches, on the inner aspect of the right knee, extending up a little on to the thigh. The largest spot was of irregular outline, about one inch by two; the others were rounded, about a quarter of an inch to an inch in diameter. They were of a dull purple color. There were similar patches on the left instep. They were said to have appeared February 4, and the patient states that similar lesions have occurred

FIG. 3.—Prurigo nodularis. Miss S. O.

at intervals for the past six months, each outbreak lasting a week or two. They seem to have no connection with menstruation, constipation, or errors of diet, but are usually preceded and accompanied by a period of intense itching. At the outbreak of this attack the patient was on a low protein diet, eating meat but once a week, and nevertheless complaining of aching of the muscles on slight exertion.

On this date a group of four small papules was discovered, forming a line about an inch long, the lowest one about an inch and a half above the inner end of the right clavicle. They were said to have been present for several months, at times hardly visible, but very prominent at periods of increased itching.

On February 18, three white spots, each about three-quarters of an inch in diameter, appeared on the back. They were very itchy, and the surrounding skin was red. They lasted not over two days.

Nodules were excised from the right arm on December 16, 1913, for microscopic examination. The wounds healed readily, but within a few weeks a fresh nodule had developed at the site of one of those excised. It is to be noted also that a nodule is present in the scar left by a biopsy performed at the Skin and Cancer Hospital. Another nodule was removed from the leg on March 11, 1914.

FIG. 4.—Prurigo nodularis. Miss S. O.

The microscopic examination of these nodules revealed no features not already described by previous authors.

DISCUSSION. The two cases present many points of similarity, and yet differ in several very important respects. In both there is intense itching, long duration, and the appearance of firm papules. Both patients state that papules have been present from the start, but a careful examination of the man shows broad areas of skin where lichenification is in progress, with no well-defined papules at all, or only doubtful ones in the older parts. It is only on the legs, where the disease began, that large papules are found, and wherever there are well-marked papules the skin between is pig-

mented, markedly thickened, and shows many white, firm scar-like spots, which appear to mark the sites of former papules. The appearance of the woman's skin is entirely different. In her case the tumors arise from an apparently normal skin, and in the places where the disease has most recently appeared, as on the arms, there is no sign of thickening or lichenification, but, on the other hand, distinct, though small, papules. The same holds true of her hands and ankles, where the disease first appeared; the skin is coarse and harsh, it is true, but only slightly thickened and not lichenified. She insists that a tumor, once established, never disappears entirely, and her statement is borne out by the appearance of the skin and its behavior during the four months it has been under observation.

These two patients may be taken as examples of two distinct clinical conditions, a number of examples of each of which have been recorded in medical literature. The group represented by the woman includes cases reported by Hardaway,[1] Baker,[2] Johnson,[3] Kreibich,[4] Hjelmann,[5] W. Pick,[6] Brocq,[7] Schamberg and Herschler,[8] C. J. White,[9] Hyde,[10] Jackson,[11] Fasal,[12] Zeisler,[13] Sutton,[14] and Stelwagon.[15]

[1] Case of Multiple Tumors of the Skin, Accompanied by Intense Pruritus, Arch. Dermat., 1880, p. 129.

[2] Cited by Crocker, Trans. Internat. Med. Cong. at Rome 1894, p. 34, and Dis. of Skin, 3d ed., Phila., 1908, i, 162.

[3] A Papular Persistent Dermatosis, Jour. Cut. Dis, 1899, p. 49 (with illustrations).

[4] Ueber Urticaria Chronica (Two Cases Described as Urticaria Perstans Verrucosa), Arch. f. Dermat. u. Syph., 1899, xlviii, 163 (with illustration).

[5] Ett fall af urticaria perstans verrucosa, Finska Läkaresällskapets Handlingar, 1899, xli, 1236 (with illustrations). An abstract of this report is printed in the Jour. Cut. Dis., 1900, p. 470, and is probably the source of information of most authors who refer to the case. It is credited to the St. Louis Med. and Surg. Jour., where an article with a similar title appears on page 96, published August, 1900. This article is itself an abstract, and is credited to Bull. Med. and Surg., 1900. There was no such periodical as Bulletin of Medicine and Surgery in the year 1900, but the Medical Bulletin of Philadelphia, May, 1900, p. 175, contained an article almost identical with those mentioned above, which it ascribes to Prog. Med., but without mentioning date or page. This might refer to Progressive Medicine, but it does not; the article is a translation of an abstract in Le Progrès Médical, January 27, 1900, p. 60. The French journal gives no hint of the source of its abstract.

[6] Ein Fall von sogennanter Urticaria perstans, Stereoscop. Med. Atlas, 40, Lieferung, Dermatologie, 15 Folge. A. Neisser. Tafel 475. 1901.

[7] Lichen obtusus corné (five cases), La Prat. Dermat., 1902, iii, 201 (with illustrations).

[8] Two Cases of Multiple Tumors of the Skin in Negroes Associated with Itching, Jour. Cut. Dis., 1906, p. 151 (with illustrations).

[9] Lichen Obtusus Corneus, Jour. Cut. Dis., 1907, p. 386.

[10] Prurigo Nodularis, Diseases of the Skin, Phila., 1909, p. 174.

[11] Case of Multiple Tumors Associated with Itching, Jour. Cut. Dis., 1909, p. 39.

[12] Arch. f. Dermat. u. Syph., 1912, cxii, 265.

[13] A Case of So-called Prurigo Nodularis, Jour. Cut. Dis., 1912, p. 654 (with illustration).

[14] A Differential Study of Prurigo Nodularis and Urticaria Perstans, Arch. Diagnosis, 1913, p. 341 (with illustrations), also Jour. Amer. Med. Assoc., January 17, 1914, p. 181.

[15] Diseases of the Skin, 7th ed., Phila., 1914, p. 212.

These cases form a well-defined group, with many points of resemblance, and few of difference. The illustrations are strikingly alike, and often those published for one case would serve as well for another. The essential features are:

1. An eruption of firm, round or oval tumors, beginning as scarcely perceptible papules, and reaching a size of half an inch in diameter. They form rounded elevations, becoming flat-topped in the later stages, or even slightly depressed in the center. The early lesions are smooth, the older ones rough and warty. Color is not a distinctive feature—it may be that of normal skin, or pinkish, or brown, or yellowish, or gray.

2. A lesion, once well developed, seldom or never entirely disappears.

3. Itching is intense, and always accompanies or follows the development of a papule, and does not precede it.

4. The skin between the lesions is approximately normal.

Taking up in order these features of the disease, it is to be noted that the descriptions given by the observers are singularly uniform. There is some slight variation in the color and size of the lesions observed, but the color is never a marked feature, and the size varies in individual cases.

The persistence of the individual lesions has been noted by all the observers. In only four of the cases is it recorded that any of the growths have disappeared, and then only a few, while in seven it is distinctly stated that a lesion once established never disappears, and in four others it is noted that there was no change save in the size of the tumors. Of the remaining seven, one was under observation a few days only, in which time no change was observed, one showed infiltrated pigmented spots corresponding to involuted lesions, and five are those recorded by Brocq, who gives no detailed histories, but who states that the evolution is very slow. Recurrence after excision is reported in six of the cases, a high percentage, when we consider that in only nine of the cases are the histories complete enough or the period of observation long enough to judge of this feature.

The itching is a very prominent feature and was exceedingly severe in all cases, so severe as to prevent sleep, and to interfere with the daily occupation. It seems to be a symptom of the eruption, and not the cause of it. This is expressly so stated in Johnston's case and my own. Hardaway's patient, it is true, stated that each tumor arose at an itching point as a result of scratching, but Hardaway expressly states that he was unable to confirm this. I may add that repeated scratching on a small area of the forearm in my own patient was followed by no change in the skin whatever. The usual report is that the disease began as papules with itching. In five cases the itching is said to be limited to the lesions themselves, and in two cases to the lesions and their immediate neighborhood.

The skin between the lesions is normal or nearly so. The only exceptions to this rule are Hardaway's case, in which the disease had been present for twenty-two years, and in which the skin was coarse, rough, pigmented, and much thickened, and Johnston's, where the disease was of ten years' duration, in which there was some lichenification on the forearms and legs, but none on the face. Johnston remarks that this was the result of scratching, and that the pruritus which led to the scratching invariably accompanied the growth of a nodule and never preceded it.

In the case here recorded the itching was made worse by constipation and by overeating, but although the symptoms of intestinal indigestion were relieved by a restricted diet and attention to the bowels, the papules showed no change at all, and itching persisted. It seems probable that some disorder of metabolism is responsible for the disease, but what it is we do not know. The occurrence of attacks of urticaria in several of the patients, and of purpura also in the case here recorded, points strongly to a toxemia.

There are also a number of other cases recorded in German literature, generally under the name of urticaria perstans, which bear a considerable resemblance to this group, but which lack, as a rule, one or two of the essential elements. In many of them the urticarial element predominates, and the lesions, though persisting a few weeks, are not permanent. Hartmann's[16] Case III, more fully described later by Hübner,[17] is the one in which the resemblance is most striking; but here also the lesions do not appear to have been permanent, and in the second place, Hübner states that the tumors were caused by the scratching. This brings us to the second group of cases, of which G. S. may be taken as the type, and to which many of the German cases appear to belong. The distinguishing characteristic of this group is the development of tumors as a result of scratching. As the itching precedes the tumor formation, there is a more or less diffuse thickening and pigmentation of the skin, and from this area the papules arise, run their course, and disappear. There are usually many pigmented or atrophic areas which apparently occupy the sites of former lesions, and which form a rather conspicuous element of the clinical picture. Hartmann's Case IV and Case VI seem to belong to this group, and also Kreibich's case, recorded as urticaria perstans papulosa. As the disease is essentially an unusual reaction of the skin to traumatism, the clinical features are somewhat more varied and do not form so well-defined a symptom-complex as those classed as prurigo nodularis.

Török's[18] report on the changes in the skin produced by mechan-

[16] Ueber eine urticaria artige Hauterkrankung., Arch. f. Dermat. u. Syph., 1903, lxiv, 381.

[17] Ueber Tuberosis cutis pruriginosa, Arch. f. Dermat. u. Syph., 1906, lxxxi, 209.

[18] Welche Hautveränderungen können durch mechanische Reizung der Haut hervorgerufen werden? Arch. f. Dermat. u. Syph., 1902, lxiii, 39.

ical irritation is very enlightening in this respect, as he was able to induce similar changes, though of a much milder grade, by rubbing areas of normal skin day after day; and states that in certain pathological conditions the effects of irritation are much more pronounced.

My thanks are due to Dr. Trimble for the privilege of recording one of the cases, and for photographs of both of them, and to Dr. M. L. L. Welzmiller, for assistance in preparing the histological material.

A STUDY OF GASTRIC SEDIMENTS AND THEIR INTERPRETATION.

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Several years ago in aspirating the contents of a stomach by means of an Ewald aspirating bulb I noticed on the withdrawal of the tube that a small piece of tissue had been caught in the eye of the tube. This little fragment (although not more than 2 mm. in size), appropriately hardened and stained, gave a beautiful picture of the glandularis and muscularis mucosæ, at which level rupture had taken place. The case was one of gastritis acida, and I was impressed particularly with the desquamation and exfoliation of the cells at the periphery, to which attention has previously been called.[1] Thinking that such desquamation and other degenerative changes might occur more frequently than was generally believed, I determined to make the recovery of gastric sediments a routine procedure.

The first method employed was to save all of the wash water from the lavage of the fasting stomach and allow it to sediment by gravity in 1000 c.c. conical graduates, and after a few hours to decant the supernatant fluid down to the last 100 c.c., and on centrifuging this, lift up the sediment by a platinum loop, and after making an ordinary slide smear, to stain it, differentially, with eosin and methylene blue. Crude though this method was, one was often repaid by recovering recognizable elements, such as leukocytes, moulds, fungi, various bacterial groups, and, surprisingly, often epithelial cells or even bits of mucosa, from a study of which it seemed possible to make certain definite diagnostic inferences. There were marked disadvantages, however, in having to deal with large amounts of lavage water, often 3000 or 4000 c.c., which

[1] Cf. Anthony Bassler, Med. Rec., November 30, 1907.

required several hours to settle before being centrifuged, during which time many regressive degenerative alterations might occur in standing at room temperature. Furthermore, the making of even several platinum loop smears, from the centrifuge sediment, only represented a fractional amount of the total sediment. So after various modifications were applied the following method was adopted and carried out, first in the gastro-intestinal department of the German Hospital and later in the stomach clinic at Jefferson Hospital.

To make the procedure less formidable to the patient, instead of using the ordinary size stomach tube the use of a small metal capsule was suggested by my colleague, Dr. J. Quincy Thomas. This capsule is 1.5 cm. long by 6 mm. in diameter, and having a shaft 4 mm. long by 3 mm. in diameter, to which a small capillary rubber tube is securely fastened by a silk thread. The capsule is perforated at the extreme tip with a hole 1.5 mm. in diameter, in a line continuous with the caliber of the tube, and the body of the capsule is similarly perforated with eight additional holes 1.5 mm. in diameter. To facilitate cleaning the capsule is made in two parts, which unite by a screw thread. These metal tips are similar to those introduced by Einhorn for the recovery of duodenal contents or for duodenal feeding, but are made of German silver and silver plated, which is inexpensive and serviceable. The capillary rubber tube attached to this capsule is 1 meter long and of various calibrations. The smallest one that can be serviceably used is 3 mm. in diameter. This tube can be readily swallowed with minimal discomfort, and can be left *in situ* for several hours to admit of fractional analysis of the gastric juice after an Ewald breakfast, or allowed to pass into the duodenum for the recovery and analysis of duodenal or jejunal contents.

A good routine practice is to have the patient swallow the capsule and tube on an empty stomach, preferably in the early morning fasting state, and by means of a one- or two-ounce aspirating syringe, with a capillary tip and supplied with a close-fitting asbestos plunger, gentle aspiration is made to recover the residual contents of the fasting stomach, after which from 100 to 150 c.c. of plain, warm water is introduced by means of the syringe and gently aspirated and forced back again into the stomach, perhaps a dozen times. After the first several re-aspirations it can be usually observed that the lavage water, which was at first macroscopically clear, becomes gradually turbid and contains variously-sized flocculent bodies, ranging from pin-point to 3 to 5 mm. in size. During this period of aspiration and re-injection a stethoscope should be applied to the abdominal wall in the gastric area, and the size, shape, and position of the stomach can be readily mapped out by determining the maximum lines of intensity of the auscultatory tinkling and bubbling sounds. After thus douching the

gastric mucosa, all of the fluid is aspirated from the stomach and then a small portion tested for occult blood and the remainder mixed with equal parts of a 10 per cent. solution of formalin. The residual gastric contents or material aspirated from the stomach is recorded in cubic centimeters, allowed to filter, and the filtrate tested for its acidity to determine hypersecretory states; the filter paper is then punctured and the residue washed into a clean bottle with the 10 per cent. formalin solution, and both specimens, properly labeled, are then sent to the laboratory to be handled in the following way:

TECHNIC OF PREPARING SEDIMENTS FOR STAINING. 1. Add to gastric washings an equal quantity of 10 per cent. formalin and allow to stand for at least three hours.

2. Filter through a smooth filter paper. After filtration wash the sediment down to the tip of the filter paper by means of a wash bottle.

3. Cut off the tip of the filter paper containing the sediment. Fold the paper to prevent the escape of the sediment. Wrap the paper in one layer of gauze; tie it fast with a thread.

4. Place in acetone I for one hour.
5. Place in acetone II for one hour.
6. Place in acetone III for two hours.
7. Place in paraffin and chloroform, each one hour.
8. Place in paraffin (M. P., 52° C.), each one hour.
9. Place in paraffin (M. P., 52° C.), each two hours.
10. Imbed in paraffin.
    (*a*) Attach to a block of vulcanized fiber by means of melted paraffin a piece of cardboard, 6 x 12 x 2 mm.
    (*b*) Unfold the filter paper and remove the sediment. Mold it into a small block and attach to the pasteboard with melted paraffin.
    (*c*) Wrap around the block a piece of paper 25 mm. wide, previously dipped in paraffin.
    (*d*) Float block in iced water and fill the paper box with melted paraffin (M. P., 52° C.)
    (*e*) Trim the paraffin down to the plane of sediment.
11. Cut serial sections.
12. Float the sections on warm water and place them on slides previously covered with a thin layer of Meyer's egg albumen.
13. Wipe off the excess of water from the edges of the slides.
14. Place the sections in a dry heat sterilizer, at 70° to 80° C., for thirty minutes or until sections are perfectly dry.

Staining. 15. Place sections in xylol (in Coplin's jars) for five to ten minutes to remove paraffin.

16. Place sections in absolute alcohol for five minutes.
17. Place sections in 95 per cent. alcohol for five minutes.
18. Place sections in 80 per cent. alcohol for five minutes.

19. Place sections in water for five minutes.
20. Place sections in hematoxylin for five minutes.
21. Place sections under a slow stream of running water until they turn blue.
22. Place sections in a weak aqueous solution (about 1 per cent.) of eosin.
23. Place sections in 80 per cent. alcohol for a few seconds.
24. Place sections in 95 per cent. alcohol for a few seconds.
25. Place sections in absolute alcohol for a few seconds.
26. Place sections in xylol for ten or more minutes (to clear).
27. Mount in balsam.

Normally, in the slides from the aspirated fasting residue one finds occasional epithelial cells; occasional leukocytes with protoplasm intact in those cases in which chemical titration shows faintly acid or neutral or slightly alkaline reaction. Boas and Paul Cohnheim have pointed out that digested protoplasm of epithelium or leukocytes indicates the presence of free hydrochloric acid and pepsin. When the protoplasm of the epithelial cells is still intact it is possible to differentiate endogenous gastric cells and those originating from the mouth, pharynx, respiratory track, and esophagus. Normally, one frequently encounters the snail-like bodies, first described by Jaworski,[2] which Boas and Paul Cohnheim believe to be mucus, which have been acted upon by hydrochloric acid. If there has been regurgitation from the duodenum there may be crystals of some of the bile salts.

Pathologically, in the fasting morning stomach one may find remnants of food eaten the night before, such as muscle fibers still striated or partially digested; starch granules; vegetable cells; seeds from berries, any of which from the twelve-hour fasting stomach is indicative of motor insufficiency, due either to pyloric obstruction or rarely to advanced atony. Associated with this, if one finds sarcinæ in numbers or many yeast cells in process of germination it would suggest gastric dilatation with stagnation and fermentation. Sarcinæ are rarely found in the ectasia of cancer, except the ulcus carcinomatosum type. It should be remembered that small amounts of food remnants are not significantly pathological (cryptic mucosæ and cavities in teeth).

Paul Cohnheim attaches importance to infusoria like Trichomonas hominis and Megastoma entericum, and believes they are associated with cancer when the motility of the stomach is not affected. Personally, I have never encountered them. They require for their development an absence of hydrochloric acid, an alkaline medium, and a cryptic mucosa. Mucus from the respiratory track will float, owing to its air content. Microscopically, it is characterized by containing alveolar cells and myelin drops, while colum-

[2] Münch. med. Wchnschr., 1887.

nar epithelium indicates its derivation from the gastric mucous membrane. Also, in gastric dilatation one occasionally encounters spores and mycelial cells from vegetable moulds. Leukocytes are indicative of an inflammatory reaction. It has been stated that if they occur in large numbers it is strongly suggestive of phlegmonous or suppurative gastritis, an extremely rare condition. It has been my experience, however, to find large numbers of leukocytes in all cases of gastric ulcer, in many of the simple forms of gastritis in the inflammatory or congestive stage, and in cancer of the stomach, affecting chiefly the glandularis. Pathologically, a significant finding is the presence of Oppler-Boas bacilli, which most usually occurs in the subacid or anacid gastric juices, associated with retention and stagnation. Most commonly the presence of lactic acid is readily demonstrable when these bacilli are found. Their presence has so often been seen to be associated with cancer of the stomach as to be extremely suggestive of this condition, but by no means pathognomonic. They are large non-motile bacilli with a somewhat typical morphological arrangement in long chains, and are readily differentiated from the Leptothrix buccalis by acting negatively to Gram's stain. In gastric sediments prepared as above described they have a tendency to arrange themselves in dense masses, interlaced with one another, and resemble hair-like balls when viewed under a low-power microscope.

The normal stomach should contain very few bacteria, and when they do occur in large numbers it has been considered to be due to a gastric juice poor in antiseptic property. I believe when the bacterial flora of the stomach is found high that one is dealing with a distinctly pathological condition. The most common normal invader of the stomach is the Bacillus coli group, but the appearance of diphtheroid bacilli, staphylococci, and particularly various types of streptococci indicates trouble. Here, too, one meets with a pathologically increased number of leukocytes.

It is surprising how often small isolated fragments or flakes of gastric mucosa will be recovered by this method. Minute particles, barely of macroscopic size, which would readily escape detection in the lavage water, may prove to be the one point upon which the correct diagnosis can be made. Furthermore, it is often possible, from a microscopic study of these bits of mucosa, to determine from which segment of the stomach they come, whether the fundic, prepyloric, or antrum pyloric, bearing in mind the anatomical distribution of the different types of glands. Microscopically, these minute fragments may show only the peripheral portion of the villus, extending down to various depths through the glandularis, while in the larger fragments the entire width of the mucosa, at times including the muscularis mucosæ, will be found. It is often possible to differentiate accurately the following conditions:

CANCER OF THE STOMACH. It is not uncommon to find (see Cases III and IV, Figs. 4 and 8) fragments of gastric mucosa which show gastric tubules with broken basement membranes and atypical invasive proliferation of the epithelial cells through the interglandular stroma, and other glands may show various types of degeneration, parenchymatous, mucoidal, vacuolary, or atrophic. In all these retrogressive degenerations the staining reactions are poor as compared with the progressive carcinomatous changes. If the fragment of mucosa extends down to the submucosa, finger-like processes of carcinomatous invasion affecting the fundic portions of glands, or even collections or nests of carcinoma cells involving the lymphoid tissue, often showing beautiful mitotic figures, may be found. There is almost invariably a well-marked leukocytic infiltration of the interglandular stroma, frequently associated with pyogenic bacteria, particularly streptococci. When bits of mucosa with recognizable glandular elements can not be found, one may frequently see microscopic fields showing areas of necrosis, plentifully studded with polynuclear leukocytes and invaded by bacteria. Often in the centre of these eosin-stained areas of necrosis may be seen masses of granular amorphous-like debris, staining heavily with methylene blue or hematoxylin, which suggests the remains of degenerated epithelial cells, carcinomatous or other, in all stages short of coagulation necrosis (see Figs. 2, 3 and 5). One finds the bacteria massed chiefly at this point, the degenerated cells evidently furnishing an excellent pabulum. Around these necrotic areas will frequently be found immense numbers of Oppler-Boas bacilli, often arranged in such dense clusters of interlaced bacteria as to resemble balls of hair when viewed under low power (see Figs. 2, 3 and 5).

Occasionally one will find fairly large clusters or nests of recognizable cancer cells, often in number up to 100 cells, as in Case I of this series (see Fig. 1). In cancer cases with pyloric obstruction the twelve-hour fasting stomach sediment will show various food rests, meat fibers, vegetable cells, starch granules, fat droplets, or crystals, and if there is fermentation, yeast cells in abundance. Red-blood corpuscles may occasionally be found intact, more commonly in various stages of crenation, and most frequently as hematin crystals. Crystals of bile salts may also be found.

Even if definitely diagnostic isolated cancer cells or bits of mucosa showing carcinomatous degeneration can not be found, the presence of areas of necrosis showing leukocytic infiltration and bacterial invasion will strongly suggest either gastric cancer or gastric ulcer. If Oppler-Boas bacilli are present and the chemical analysis of the gastric juice approaches the subacid or anacid curves the diagnosis points more particularly to cancer (see Chart I, Case IV). A positive Wolff-Junghans reaction would support this point of view.

It is, of course, understood that, as a rule, these laboratory

findings are the tail to the kite as compared to a carefully taken anamnesis, physical examination, and a critical clinical scrutiny of the case; but coupled with the latter they may prove to be the turning-point in the diagnosis, and, indeed, it not unfrequently occurs that the diagnosis is definitely pathologically made by the finding of recognizable cancer cells (see Cases I, III, and IV, Figs. 1, 4, and 8).

Gastric Ulcer. While it is more difficult here to make a definitely pathological diagnosis from a gastric sediment study, nevertheless the finding of areas of necrosis with numerous leukocytes and pyogenic bacteria indicates the presence of an ulcerative process whether superficial or deep. The absence of Oppler-Boas bacilli is likewise suggestive. If coupled with this there are bits of the glandularis mucosæ showing the gastric tubules well marked and the cells reacting sharply to the differential stains and the interglandular stroma invaded by leukocytes, the likelihood of this diagnosis would be increased (see Fig. 10). Here, too, one frequently encounters isolated exfoliated epithelial cells, particularly the border or cover cells, reacting well to eosin, either intact or showing granular degeneration. A normal or hyperchlorhydric fractionation curve of the gastric juice, especially when associated with the presence of occult blood, would support this contention. It should be thoroughly borne in mind, however, that the presence of occult blood by no means always indicates ulcer or cancer, it being so frequently encountered in superficial erosions, in states of chronic passive congestion with a friable gastric mucosæ, and in many cases of achylia gastrica, as recently pointed out by J. T. Pilcher[3] in a series of cases studied at the Mayo Clinic.

Chronic Gastritis. In hypertrophic glandular gastritis and gastritis acida the pathological diagnosis depends upon the finding of fragments or flakes of mucous membrane presenting a well-marked hyperplasia of the glandular elements, with the cells showing good staining power. This applies most particularly to the base or fundic portion of the glands, whereas the cells toward the periphery will often show granular degeneration, loss of staining power, and absence of nuclei. This peripheral portion frequently desquamates or sloughs off and is found in isolated areas of the microscopic field (see Fig. 7). The interglandular stroma is seen to be infiltrated with an increased number of leukocytes of the lymphoid type in the more chronic processes and a predominance of polynuclear varieties in the acute stages. The venules are usually enlarged or dilated, and areas of pigmentation and congestion may be seen.

Atrophic Gastritis. Here recoverable bits of gastric mucosa will show a considerable diminution in number of the gastric tubules, with marked irregularity in their distribution; their alignment is

[3] Jour. Amer. Med. Assoc., November 19, 1910.

very imperfect and few glands can be traced from fundus to neck. The cells stain poorly and show mucoid and fatty degeneration, with marked vacuolization. Frequently, cells are seen separating or completely broken off from the basement membrane and lying in the lumen of the tubule. In fact, all of the epithelium may be completely denuded from the tubule, leaving empty spaces in the mucosa.

The leukocytic infiltration is usually of the lymphocytic type, and areas of venous congestion are relatively infrequent. In the same microscopic field, or in other portions of the sediment in the same case, may be found bits of mucosa showing practically normal glandular elements, and it may be rightfully argued that the findings of such microscopic fragments of the mucosa showing various pathological states may not represent a true picture of the amount of organic damage or degree of functional power of the stomach as a whole. Nevertheless, the above findings, associated with the study of the fractionation curves, will often corroborate or point out the clinical diagnosis.

Achylia Gastrica. In the recovery of bits of mucous membrane in cases of this type the noteworthy features have been the pronounced reduction in the number of glandular tubules in various stages of benign degeneration (Fig. 9, Case V). These degenerations consist chiefly of the mucoid type, which is probably a later stage of a simple parenchymatous degeneration. Later cystic dilatations appear, and in some cases there occurs rupture of basement membranes with atypical epithelial proliferation, showing a tendency to invade the surrounding stroma. Such cases should be most carefully investigated, and repeated attempts to recover additional mucosal fragments should be made, as it may prove to be a transitional stage between a benign and an early malignant achylia. Particularly in these cases does the Wolff-Junghans reaction offer a possible means of differentiation. In all this group of cases there is a marked increase in connective tissue in the interglandular stroma, and at times wide bands of it may be seen separating small islands of degenerated tubules. Indeed, it is possible that this connective tissue overgrowth in the benign achylias may be a forerunner of that rare condition Linnitis plastica. The depth of the glandularis is strikingly diminished, and it is not uncommon to find that a single low-power microscopic field takes in the entire depth and width of the glandularis, including the muscularis mucosæ, at which point rupture most commonly occurs. At the peripheral portion of the glandularis may be seen dilated venules markedly congested and with extravasation or diapedesis of red-blood corpuscles, which explains the occasional (frequent?) demonstration of occult blood.[4] At the peripheral portion, too, may be

[4] Cf. Pilcher, Jour. Am. Med. Assn., November 19, 1910.

found a deep layer of mucus, and islands of mucus may also be seen in isolated portions of the sections.

When one is successful in recovering fragments of mucosa showing these pathological changes it checks up nicely the fractionation curves of the achylic type and would serve to differentiate between the psychical achylia occurring during the first stage of digestion and the total chemical achylia persisting throughout the entire digestive cycle (see Chart II, Case V).

Gastric Atony with Dilatation. In the early cases the sediment returns are usually negative save for amorphous debris and patches of mucus in which are enmeshed occasional leukocytes. In the more advanced cases with benign motor insufficiency are found various food rests even on a twelve-hour fasting stomach, although it is uncommon to find this unassociated with some degree of pyloric stenosis.

Gastric Dilatation with Fermentation. In cases of gastric dilatation with fermentation one will frequently find in addition groups of sarcinæ, germinating yeast cells, spore-bearing fungi, and mycelial threads. Bacteriologically, many groups of organisms may be represented, chiefly, however, of the spore-bearing type.

Hypersecretion Continua (Reichmann's Disease). Oftentimes the sediments are practically negative except for a granular amorphous debris with crystalline deposits of bile salts. If there is an associated inflammatory condition (a gastritis), one will find the nuclei of numerous leukocytes with protoplasm digested as well as free nuclei from exfoliated epithelial cells. In the inflammatory types under oil immersion can frequently be made out a marked increase in the bacterial flora. Since so many cases of hypersecretion are found associated with gastric dilatation sequential to either atony, pylorospasm, pyloric stenosis, or chronic appendicitis, food rests may be frequently encountered.

Esophageal Sediments. Similarly, in douching the esophagus by this method one may recover esophageal sediments of diagnostic import, as in cases of cardiospasm with esophageal dilatation. In cases of esophageal cancer, minute bits of tissue containing nests of cancer cells may be found, together with necrotic debris, studded with leukocytes and invaded by bacteria. In cases of esophagitis following the ingestion of corrosive poisons there may be recovered bits of necrotic mucosa showing a high degree of ulcerative inflammation. It is noteworthy that in cardiospasm, and I believe this to be pathognomonic of this condition, it will be found possible to douche the esophagus and recover from the esophagus all of the lavage fluid introduced without having to pass the tube into the stomach. (This point has been repeatedly demonstrated in a case which will be reported in full at an early date.)

Conclusions. 1. The routine study of gastric sediments will be found to give information of both diagnostic and prognostic importance.

2. In those cases in which are recovered fragments of mucosa showing pathological alterations the clinical diagnosis may be checked up or supported as in no other way short of surgical exploration. This is notably the case in cancer of the stomach involving the glandularis. One may be rewarded by positive findings in comparatively early cases of cancer, which are clinically of the borderline type.

3. In clinically doubtful or obscure cases exhibiting gastric symptoms a study of one or several slides of gastric sediment may reveal sufficient pathological evidence to point correctly the diagnostic accusing finger.

4. A single pathologically negative sediment means nothing, and is to be regarded in the same way as failure to recover tubercle bacillus from the sputum of patients clinically tubercular.

5. Repeated pathologically negative sediments in a given case argues strongly in favor of functional rather than organic gastric disease.

6. When organic disease is strongly suspected, notwithstanding repeated pathologically negative sediments, one should critically survey the technic of obtaining and preparing the specimen.

I desire to acknowledge the courtesy of Dr. John B. Deaver, in the use of hospital notes on some of his patients on whom these studies were made, and to express my thanks to Dr. Carl E. Becker, of the pathological laboratory of the German Hospital, and to Mr. John Eiman, of the pathological laboratory of the Methodist Hospital, for their cordial coöperation and their painstaking care in the preparation of the specimens.

REPORT OF CASES.

CASE I (Carcinoma of the Stomach).—H. F., aged sixty-two years; married; occupation, machinist.

Chief Complaint. Indigestion, with vomiting and constant pain in the stomach.

Present Illness. Four months ago he began to get pain in his stomach, occurring two to three hours after meals and relieved by eating. This relief would last for two hours and then the pain would begin again. About the same time he began to get attacks of vomiting; says he never vomited blood, but has vomited dark brown material. Associated belching and water brash. Constipated. No jaundice. Has lost fifty pounds in weight in the last nine months.

Past Medical History. Never sick before. No history of venereal diseases.

Social History. Smokes and uses beer moderately. Has always been a hard-working man, with regular habits.

Family History. Wife and four children living and well. No family history of cancer.

Physical Examination. Undernourished adult male, with no evident pain or distress. Eyes, ears, and nose negative. Tongue rather beefy red. Teeth in poor condition with pyorrhea. Neck: a few palpable cervical lymph glands. Skin slightly anemic and cachectic, with considerable emaciation.

Lungs: Small, moist rales at the posterior left apex and a few rales over the right lung posteriorly. Slight impairment of resonance at the left apex.

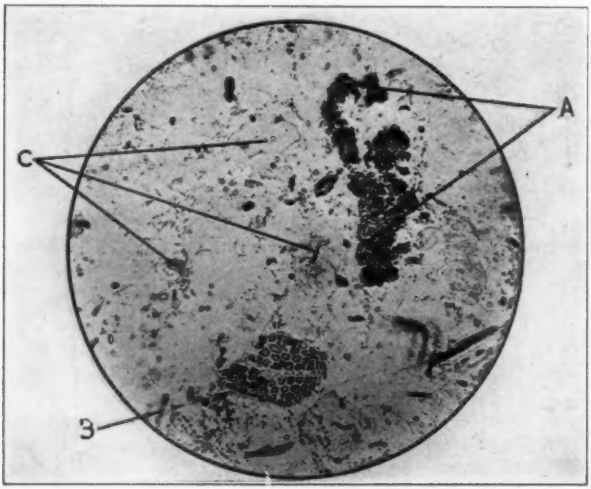


FIG. 1.—Nest of cancer cells from Case I, H. F., aged sixty-two years. Free HCl, 0; total acidity, 8. Occult blood positive. Lactic acid negative. Oppler-Boas bacilli not found. Wolff-Junghans reaction positive in $\frac{1}{320}$ dilution. *A*, nest of cancer cells; *B*, bundles of striated muscle fibers from retained food residue; *C*, necrotic debris with streptococcic invasion. × 100.

Heart: Normal in size and position. Sounds are free from murmurs and accentuations, but first sound at the apex is of poor muscular quality and can scarcely be heard. Peripheral blood-vessels sclerotic.

Blood-pressure: Systolic, 160; diastolic, 78.

Abdomen: Walls thin; tenderness in epigastrium, especially just left of the midline. A sense of resistance can be felt in this area—almost like a movable mass. Abdomen otherwise negative.

Extremities and genitalia negative.

Gastric Analysis: Sixty minutes after Ewald breakfast. Quantity, 90 c.c. Brownish yellow, putrid odor, faintly alkaline. Bile negative. Occult blood positive to benzidine and slightly

positive to guaiac. Free HCl absent; total acidity, 8; lactic acid absent.

Microscopically: A few starch granules partially digested; granular debris. Oppler-Boas bacilli absent. Wolff-Junghans reaction positive in dilution 1 to 320.

Gastric Sediment: Shows nest of cancer cells. Necrotic debris, and food rests on six hour fasting stomach (see Fig. 1).

Stool: Grayish-green; semisolid; moderate amount; characteristic odor; alkaline reaction. Bile positive. Occult blood positive to benzidine and to guaiac.

Microscopically: Bile-stained vegetable cells; fatty acid crystals and crystals of triple phosphate; granular debris and bacteria.

Blood Count: Hemoglobin, 58 per cent.; red-blood cells, 3,890,000; color index: 0.76; white blood-cells, 11,400.

Differential Count: Polymorphonuclear neutrophiles, 76 per cent.; lymphocytes, 24 per cent.; large mononuclears, 0; transitionals, 0; eosinophiles, 0; total, 100 per cent.

Fluoroscopic Examination: Stomach not markedly ptotic or dilated. No absolute mass, but there is some slight increase in density toward the cardiac end of the greater curvature.

Operation January 9, 1913 (Dr. Deaver). Upper right rectus incision. Stomach exposed. A hard mass was found on the entire lesser curvature extending to the greater curvature and involving the great omentum. Type is scirrhus. Radical cure not possible. Usual closure of wound. Dry dressing.

Case II (Carcinoma of the Stomach).—J. G., aged sixty-four years; married; occupation, cement finisher.

Chief Complaint. Constant pain in epigastrium; loss of weight; anorexia; constipation.

Present Illness. Two months prior to admission he developed distress in the gastric area, occurring immediately after meals, with a sense of weight in the epigastrium. "The food seems to lie in my stomach and does not pass out." He has had to lie down on account of weakness after each meal, has difficulty in breathing, and has a constant gnawing pain in the epigastrium, without reference to eating. The pain does not keep him awake at night. His appetite has dwindled so that he can eat very little, and he relishes only liquids and oatmeal. He can not digest any meat and is violently constipated, using drastic cathartics every day. He has never vomited; he has never noticed any blood in his stools, but they have lately been of a dark, blackish-brown color. He, himself, found a lump in his epigastrium about six weeks ago that he thinks is growing larger. He has lost twenty pounds in five weeks.

Family History. Wife and three children living; one died in infancy: one of appendicitis and one of epilepsy. No history of cancer, tuberculosis, or hemophilia.

Past Medical History. Unimportant.

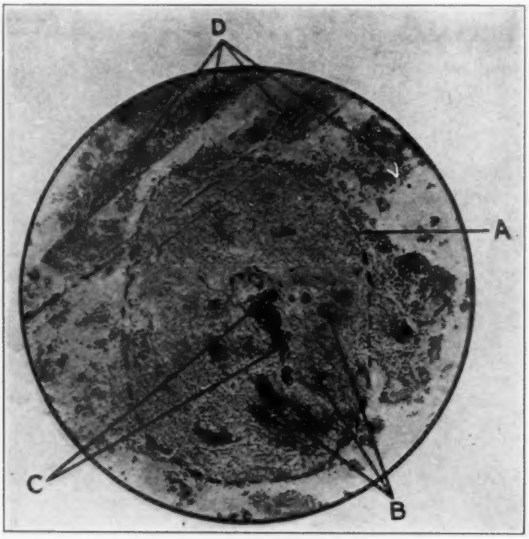


FIG. 2.—Gastric sediment from Case II, J. G., aged sixty-four years, showing necrotic debris and masses of Oppler-Boas bacilli and large numbers of leukocytes. *A*, necrotic debris; *B*, masses of Oppler-Boas bacilli; *C*, necrotic carcinomatous debris; *D*, collections of leukocytes. × 100.

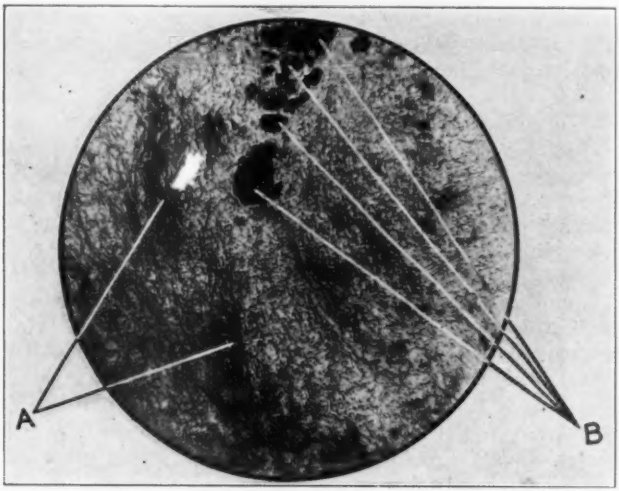


FIG. 3.—Oil immersion of Fig. 2, showing masses of Oppler-Boas bacilli. *A*, masses of Oppler-Boas bacilli; *B*, necrotic carcinomatous debris. × 800.

Social History. Denies venereal disease; smokes moderately; does not use alcohol.

Physical Examination. Emaciated adult male in no great pain. Eyes and nose negative. Ears: left, negative; right, quite deaf. Mouth: mucous membranes pale. Teeth: decayed and missing. Tongue: clean and furrowed.

Chest: Heart and lungs surgically negative.

Abdomen: Muscular, difficult to palpate; peristalsis poor; some distention; no rigidity. Mass present, beginning 5 cm. below the xiphoid, extending 4 cm. to the right of the midline and 2.5 cm. to the left of the midline; is hard, resistant, moves slightly downward on deep inspiration, and seemingly involves greater curvature throughout; pain not present on deep palpation. Otherwise abdominal examination is negative except for left inguinal hernia. Genitalia and extremities negative. Blood-pressure: systolic, 140; diastolic, 70.

Blood Count: Hemaglobin, 72; red-blood cells, 4,740,000; color index, 0.76; white-blood cells, 7155.

Differential Count: Polymorphonuclear neutrophiles, 53 per cent.; lymphocytes, 23 per cent.; large mononuclears, 16 per cent.; transitionals, 5 per cent.; eosinophiles, 3 per cent.; total, 100 per cent.

Stool: Yellowish brown; normal consistency; moderate amount; characteristic odor. Alkaline reaction. Bile strongly positive. Occult blood faintly positive to benzidine and negative to guaiac.

Microscopically: Bile-stained vegetable cells, mucus, and debris. Free fat globules and bacteria.

Urinalyses: Unimportant.

Fluoroscopic Examination. Lower border of the stomach reaches to the umbilicus. Shadow of a dense mass apparently involving the greater curvature.

Gastric Sediment Study: Shows a large amount of necrotic debris with degenerated epithelial cells with enormous collections of Oppler-Boas bacilli, particularly surrounding the necrotic epithelial debris, and very large numbers of leukocytes, chiefly polynuclear, with protoplasm intact (see Figs. 2 and 3).

Operation December 4, 1912 (Dr. Deaver). Upper right rectus incision. Large mass found involving the anterior wall of the stomach and extending up to the cardia. Carcinomatous invasion of the mesentery and pancreas. Case inoperable. Wound closed.

CASE III (Carcinoma of the Stomach).—S. H., aged fifty-nine years; married; occupation, scale maker.

Chief Complaint. Vomiting and pain after eating and belching.

Present Illness. Six months ago had an attack of severe hiccoughing, with chills, lasting five days and associated with vomiting. He has never felt well since that time. Appetite lessened, and for the last six weeks has had attacks of vomiting, occurring three to

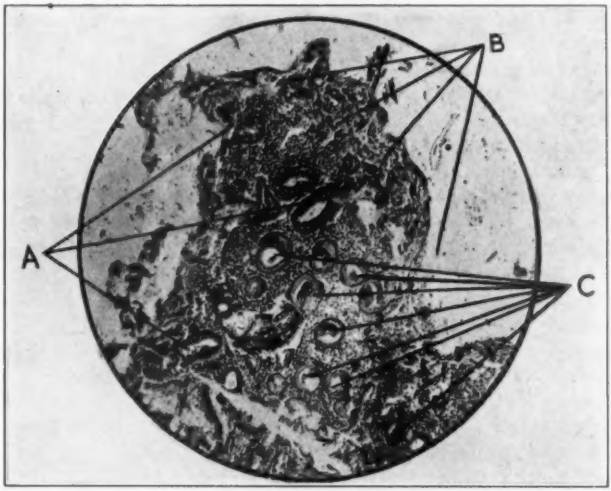


FIG. 4.—Fragment of gastric mucosa showing carcinomatous degeneration. Case III, S. H., aged fifty-nine years. Free HCl, 0; total acidity, 52. Lactic acid positive. Occult blood positive. Oppler-Boas bacilli present. *A*, rupture of basement membrane and a typical proliferation of epithelium; *B*, carcinomatous degeneration; *C*, gastric tubules in various stages of atrophy. × 100.

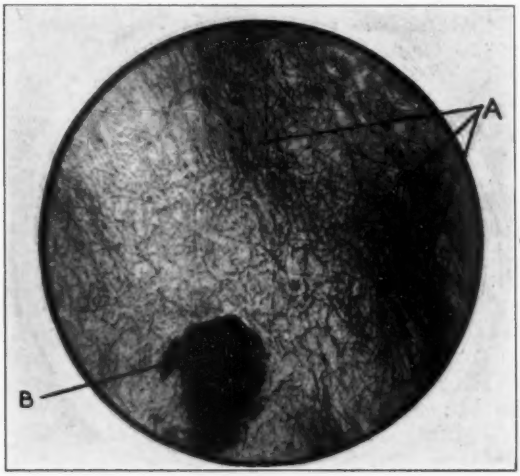


FIG. 5.—Gastric sediment. Case III, S. H., aged fifty-nine years, showing large numbers of Oppler-Boas bacilli. *A*, Oppler-Boas bacilli; *B*, necrotic cancer cells. × 800.

four hours after eating. No definite retention vomiting, nor has he vomited bloody or blackish material. He does not have much pain before vomiting, but says he feels as though the food was being rolled up into a ball and vomiting gives relief. The pain is not referred to the back, but it is located in the epigastrium and over the gall-bladder. He has noticed that the pain waked him up at night when sleeping on his right side. He has lost twenty pounds in weight in six months. He has much gaseous distention of the stomach and belches a great deal. He has pyrosis but no water brash; has not been jaundiced. Bowels are constipated; no melena. Condition has improved a little during the past two weeks.

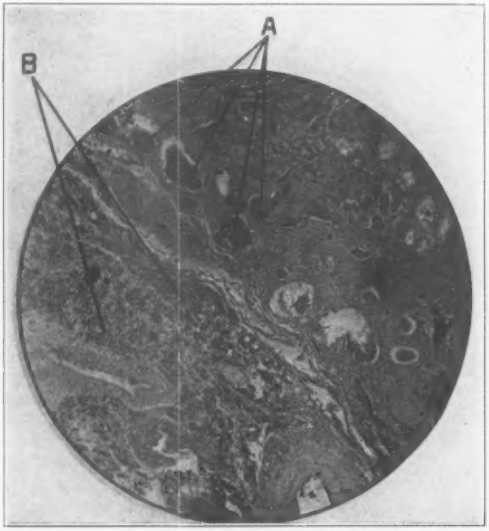


FIG. 6.—Postoperative section (subtotal gastroectomy) from gastric mucosa of Case III, S. H., confirming diagnosis of cancer. *A*, nest of cancer cells in muscularis mucosæ; *B*, infiltration of leukocytes. × 100.

Past Medical History. "Gastric fever" six years ago. Indefinite history difficult to interpret.

Social History. Uses alcohol moderately.

Family History. Unimportant.

Physical Examination. Somewhat emaciated looking; skin pale; eyes, ears, nose, and mouth negative. Lungs surgically negative.

Abdomen: Scaphoidal. Skin: thin and lax muscular walls. No masses detected. Deep palpation elicits diffuse epigastric tenderness, with distinct muscle spasm and tenderness over McBurney's point, but not over the gall-bladder. Otherwise abdomen is negative.

Genitalia and extremities: Negative.

Blood-pressure: Systolic, 112; diastolic, 90.

Blood Count: Hemaglobin, 77; red-blood cells, 4,360,000; color index, 0.89; white blood cells, 8500.

Differential Count: Polymorphonuclear neutrophiles, 63 per cent.; lymphocytes, 32 per cent.; large mononuclears, 1 per cent.; transitionals, 4 per cent.; total, 100 per cent.

Gastric Analysis: *Full Meal* (six-hour stomach): 375 c.c. recovered; light brown color; aromatic odor. Bile: negative. Occult blood, 0; free HCl, 0; total acidity, 44; lactic acid, faintly positive.

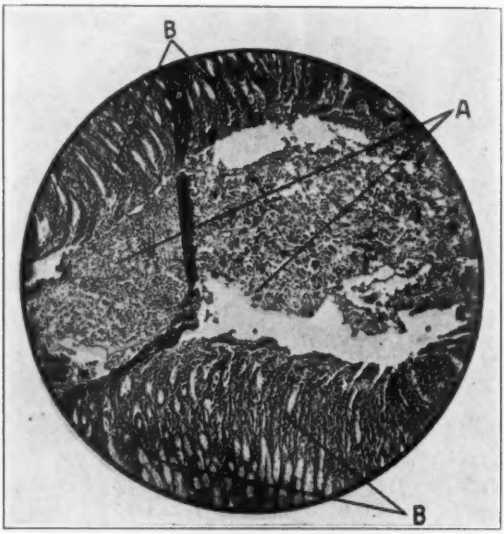


FIG. 7.—Gastric sediment of fragment of gastric mucosa from case of gastritis acida and hypersecretion. S. H., aged fifty-nine years, showing *A*, inflammatory debris containing many polynuclear leukocytes sloughing off between *B*, two folds of mucous membrane. × 100.

Microscopically. Oppler-Boas bacilli present. Granular debris; a few free fat globules and partially digested starch granules and mucus plus.

Ewald breakfast (sixty minutes): 130 c.c. recovered; yellowish-brown, aromatic odor; bile negative. Occult blood: strongly positive to benzidine and negative to guaiac. Free HCl, 0; total acidity, 52; lactic acid, positive.

Microscopically: Oppler-Boas bacilli; fat globules; partially digested starch; granular debris.

Cammidge "C" reaction: Positive.

Stool Analysis: Greenish-brown; fluid and small fecal masses; neutral reaction; bile strongly positive; occult blood strongly positive to benzidine. Guaiac negative.

Microscopically: Bile stained vegetable cells; few fat globules; debris and bacteria.

X-ray Reports: Stomach dilated but not markedly ptosed; lowest border one-half inch below navel; there is an obstruction to the flow of bismuth at the pylorus which shows marked density, presumably from a growth. No other masses detected.

Gastric Sediments: Show fragments of gastric mucosa, with areas of carcinomatous degeneration and gastric tubules in various stages of atrophy (see Fig. 4) and other areas showing necrotic cancer debris surrounded by masses of Oppler-Boas bacilli (see Fig. 5).

Operation February 1, 1913. Upper right rectus incision. Carcinomatous mass at pylorus and duodenum, involving lesser curvature more than the greater. Head of pancreas hardened. Partial gastrectomy and duodenectomy, removing carcinomatous mass. Posterior gastro-enterostomy. Considerable hemorrhage. Two pieces of gauze to stomach bed for drainage. Usual closure of wound at point of drainage. Patient in bad shape on table and transfused with 3000 c.c. of saline, and immediately after leaving operating room was again transfused with 1500 c.c. of saline; given active stimulation and oxygen, with no avail. Patient died of shock.

Culture: From interior of stomach at operation: Bacillus coli communis.

Pathological Report: Portion of stomach 12 cm. x 9 cm. and 4 cm. thick. Stomach hard and wall thickened. Omental attachment at greater curvature shows two hardened glands, also at lesser curvature. Inner surface of stomach is injected, granular, and shows projecting firm nodules; wall of pylorus is thickened and hard, and cut surface is pale, hard, and resembles gristle.

Microscopically: Adenocarcinoma; scirrhus with metastasis to gastric glands (see Fig. 4).

Case IV (Cancer of the Stomach).—H. M., aged forty-five years; occupation, leather worker.

Chief Complaint. Pain in the stomach and vomiting.

Present Illness. For ten months has been troubled with pain in the stomach and vomiting. Pain is at times sharp and at other times dragging and heavy; is worse at night when he lies down; sometimes relieved by eating and sometimes not; pain is nearly always present to some extent; does not vomit except when pain has been severe; vomiting has been distinctly of the retention type; pain does not radiate; has never been jaundiced; bowels constipated; has lost fifteen pounds.

Past Medical History. Usual diseases of childhood; denies venereal history.

Social History. Irregular habits; uses alcohol at times to excess. Always more or less constant. Smokes a pipe.

Family History. Mother and two brothers died of pneumonia and father of apoplectic stroke.

Physical Examination. Fairly well-nourished adult male; hair thin and gray. Tongue clean; no tremor. Eyes, ears, nose, negative. Lungs and heart negative. Abdomen flat; walls lax; visible peristalsis seen at times. Increased resistance over recti muscle in upper abdomen. Area of liver dulness small. No mass detected. Extremities negative August 4, 1913. During the passage of the stomach tube, patient vomited large quantities of food eaten

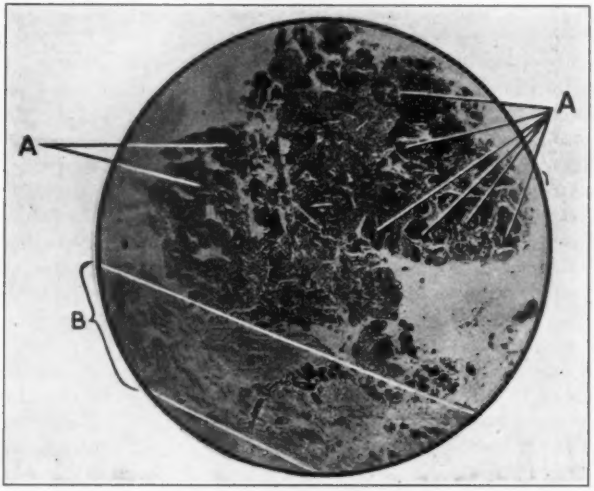


FIG. 8.—Fragment of gastric mucosa from Case IV, H. M., aged forty-five years, showing a carcinomatous degeneration. *A*, carcinomatous degeneration of gastric tubules; *B*, submucosa. × 100.

eighteen hours ago, probably 1500 c.c., of a sour, fermenting odor like cider. Free HCl, 32; combined, 20; total acidity, 76. Occult blood, negative. No inflation of lower border found at the level of the navel.

August 9. Blood count: hemoglobin, 64 per cent.; white-blood cells, 7200. Stool, brownish-black; semiformed; bile strongly positive; occult blood strongly positive to benzidine; negative to guaiac.

August 20. Wassermann reaction negative.

August 19. Fluoroscopic Examination (with 80 gm. bismuth subcarbonate). Moderate gastrectasis; lowest border of stomach is two and a half inches below the navel; sluggish peristalsis; no mass

detected. Full meal removed in seven hours. 230 c.c. of brownish-yellow, sour-smelling chyme; increased intimately mixed mucus; bile negative. Occult blood positive to benzidine; negative to guaiac. Free HCl, 53; total acidity, 95. Butyric acid positive.

Microscopically: Some undigested starch; free fat globules; epithelial cells; no Oppler-Boas bacilli.

August 22. Ewald breakfast removed in sixty minutes by aspiration bottle and over 500 c.c. of mixed contents recovered. Bread crumbs and water plus prune pulp, coagulated casein, and albumen from milk and eggs from night of August 21. Mucus plus; sour odor. Free HCl, 12; combined HCl, 0; total acidity, 30; occult blood negative in filtrate. Butyric acid positive. Starch digestion to maltose.

Microscopically: Starch granules; meat cells; sarcinæ; free fat globules; no Oppler-Boas bacilli.

Gastric Sediment, August 22. Fragment of gastric mucosa shows tubules in various stages of atrophic degeneration, with areas of carcinomatous degeneration showing an invasive tendency; high grade leukocytic infiltration; no bacteria demonstrable (see Fig. 8).

Operation advised but declined until two months later (October 6), when patient was referred to the surgical wards with an increase in symptoms and continued loss of weight.

Operation, October 8, 1913 (Dr. Deaver). Upper right rectus incision. Stomach was brought up and a mass found involving the pylorus and head of the pancreas. Posterior gastro-enterostomy was done in the usual way. Patient left the table in poor shape but reacted well to a transfusion of 2000 c.c., and was discharged from the hospital October 20.

October 6, 1914. When seen today at the Jefferson Hospital Clinic, one year after his operation, it was learned that for nine months following the gastro-enterostomy the patient had shown marked improvement in symptoms with the cessation of his retention vomiting and a gain in weight from 116 to 160 pounds. About three months ago his appetite began to fail; he began to lose weight; his symptoms of sour stomach and retention vomiting returned. Lavage today shows overnight retention. On physical examination there is a large palpable mass, about the size of a small orange, in the upper right epigastrium, about an inch and a half to the right of the midline. Liver is enlarged, the lower edge being palpable two finger-breadths below the costal margin in the mammillary line; edge rounded; upper border of liver dulness extends to the fourth interspace.

October 22. Ewald breakfast aspirated at sixty minutes; 100 c.c. of reddish-brown bread crumbs and debris, having an aromatic odor with macroscopic blood spots and great increase in intimately mixed mucus. Free HCl, 20; combined HCl, negative; total

acidity, 20. Occult blood strongly positive. Starch digestion to maltose.

Microscopically: Red blood cells; starch granules; no Oppler-Boas or other bacteria.

Wolff-Junghans reaction: Positive in 1 to 80 dilution but negative in higher dilutions.

December 22, 1914. Fractional analysis of Chart I.

Patient referred to medical wards of Jefferson Hospital October 22, where he remained until his death, March 25, 1915, twenty months after the diagnosis by gastric sediment study had been made. During the weeks prior to his death there was a rapid advance in his cachexia, anemia, and the increase in his liver dul-

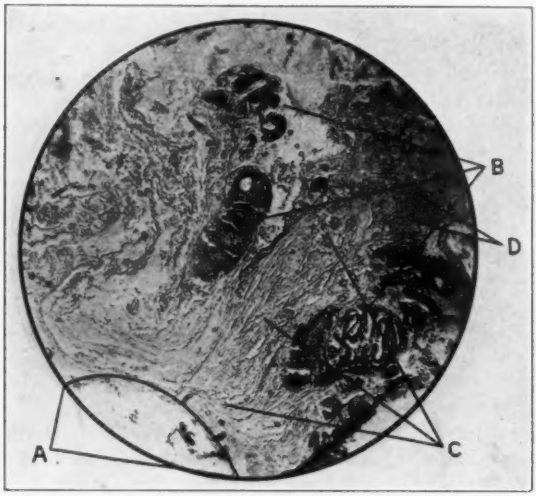


FIG. 9.—Gastric sediment showing fragment of mucosa of the human stomach in a case of advanced, atrophic gastritis. (Achylia gastrica, Case V, Mrs. A. H.) *A*, muscularis mucosæ at point of rupture; *B*, gastric tubules in various stages of atrophic degeneration; *C*, increase in interglandular connective tissue; *D*, area of congestion. × 100.

ness, with the appearance of jaundice, six weeks before he died and subsequently the development of abdominal ascites, due to blockage of his portal circulation.

At autopsy a mass was found involving the pylorus and the greater curvature, the greater omentum and the head of the pancreas, and there were extensive metastases to the mesenteric and retroperitoneal glands and to the parietal peritoneum of the abdominal wall and the under surface of the diaphragm. The liver was enormously enlarged, particularly upward. The upper border was found pushing up the diaphragm to the second interspace, and the right lung was collapsed and undergoing pressure atrophy. The

liver was everywhere studded with carcinomatous nodules, in various stages of necrosis. The gall-bladder likewise showed metastases. There were about eight quarts of straw-colored fluid in the abdominal cavity. The gastro-enterostomy opening was markedly narrowed, due to the advanced carcinomatous process along the greater curvature. The stomach was enormously dilated, and when cut open was found to contain about a pint of dark chocolate-brown granular debris, foul smelling, from which further sections were prepared which show desquamated epithelium extensively invaded by cancer.

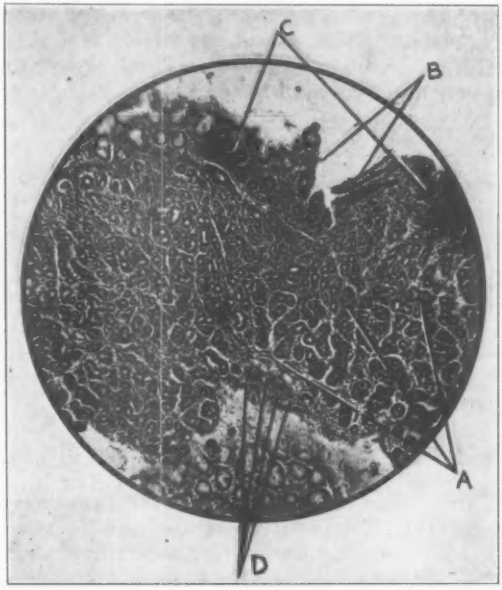


FIG. 10.—Fragment of mucosa from a case of gastric ulcer with free HCl, 86; combined HCl, 21; total acidity, 110. Occult blood positive. *A*, glandular hyperplasia; *B* area of superficial erosions; *C*, area of conjestion (occult blood positive); *D*, areas of leukocytic infiltration. × 100.

CASE V (Achylia Gastrica).—Mrs. A. H., aged thirty-one years; occupation, housework.

Complaint. Stomach trouble for fifteen years off and on; gradually getting worse; until now is unable to eat without distress. Worse symptom is excessive bloating relieved by belching; a sense of smothering with cardiac palpitation. At night must sleep on left side. Epigastric sense of pressure and discomfort; very little nausea; no heart burn; regurgitation of bland fluid; no pain; has lost eleven pounds in the last year and now weighs eighty pounds.

No cough; no sputum; no night sweats; very nervous; has headaches; is easily fatigued and has attacks of dizziness; regular in habits of eating. Bowels are constipated, scybalous, with intermittent diarrhea.

Past Medical History. Unimportant, except for tendency to anemia (simple).

Physical Examination. Fairly well nourished and developed little woman, perhaps five feet tall. Hair, eyes, ears, nose, mouth negative. Color good. Visible mucous membranes very slightly pale. Complete absence of nails on both thumbs and both index fingers, which she states is congenital, and has appeared in each generation for several generations. Chest well formed; symmetrical. Lungs negative, except for moderate dulness at both posterior apices. Heart negative. Abdomen: liver dulness normal in extent; spleen and kidneys not palpable. Stomach

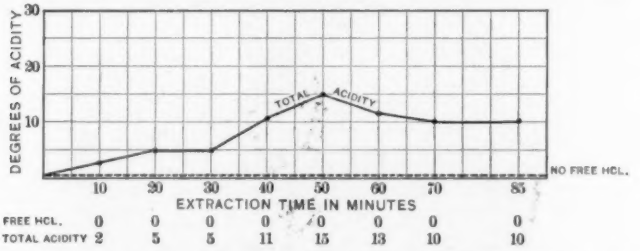


CHART I.—H. M., Case IV. December 22, 1914. Cancer of stomach. Total chemical achylia; malignant. Wolff-Junghans reaction positive. Occult blood, + +.

normal in position, somewhat dilated, particularly to the left. Knee-jerks exaggerated.

Blood Count: Red-blood cells, 5,104,000; hemoglobin, 88 per cent.; color index, 0.8; white-blood cells, 6,000. Differential count: Polymorphonuclear neutrophies, 60 per cent.; transitionals, 34 per cent.; lymphocytes, 32 per cent.; large mononuclears, 4 per cent.; total, 100 per cent. No polychromatophilia; no poikilocytosis; no neucleated red cells.

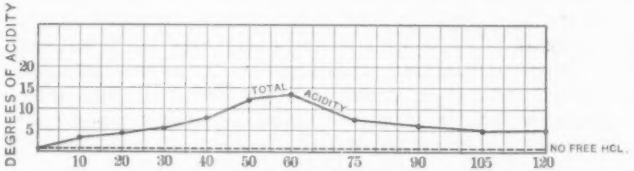
Urinary Analyses: All negative except for low specific gravities, from 1,006 to 1,015.

Examination of stools shows free-fat globules; fatty acid crystals; a few striated muscle fibers; otherwise negative.

Gastric Analyses: A series of gastric analyses (twelve in number) covering a period from July 26, 1912, to August 11, 1915, have all shown a total achylia. No free HCl occurred at any time; a combined HCl on two occasions of 2 and on one occasion 10.4, and total acidities ranging from 6 to 12 after Ewald test meals and on one occasion 15 after a mixed meal. There have never been present either enzymes or proenzymes. There has uniformly been found a considerable amount of intimately mixed mucus. Occult blood

reactions in the gastric filtrates have been negative except on one occasion. Starch digestion has been uniformly active, always passing through the erythro- and acroödextrin stages and giving well-marked sugar reactions. The odor has always been bland like that of bread soaked in water. The rate of motility has always been increased. The amounts recovered at sixty minutes from Ewald test meals of 35 gm. of bread and 300 c.c. of water, varying between 15 and 35 c.c. in amount and giving about 50 per cent. of filtrate. Fractional studies, withdrawing small amounts at intervals of ten minutes, have likewise shown a total achylia during the entire digestive cycle (see curve, Chart II).

Gastric Sediments: From time to time flakes of mucous membrane have been recovered, usually showing point of rupture at muscularis mucosæ; marked diminution in glandular elements with gastric tubules showing various stages of atrophic degeneration and a considerable increase in the interglandular connective tissue,



FREE HCL.	0	0	0	0	0	0	0	0	0	0
COMB. HCL.	0	0	0	0	0	0	0	0	0	0
TOTAL ACIDITY	1.5	4	5	8	12	13.5	7	6	5	5
ENZYMES	0	0	0	0	0	0	0	0	0	0
PROENZYMES	0	0	0	0	0	0	0	0	0	0
OCCULT BLOOD	0	0	0	0	0	0	0	0	0	0

CHART II.—Mrs. A. H., Case V. January 12, 1915. Achylia gastrica. Total chemical achylia; benign.

with occasional areas of congestion, and at the periphery often showing a layer of mucus (see Fig. 9). The Wolff-Junghans reactions have been negative, showing a demonstrable albumin ring in no dilution above 1 to 20. Under a substitution form of therapy, using fairly large amounts (30 to 60 drops) of dilute hydrochloric acid and essence of pepsin with meals and 5 to 7 grains of pancreatin three hours after meals, the progress of this case has been most satisfactory. She has been encouraged to take a morning cold bath and moderate exercise in the open air, and as much amusement as she wishes. Her diet has been arranged to give the maximum amounts of protein, carbohydrates, and fats to the point of digestive tolerance, and without showing any of these elements in her stool. For practically two years and at present she has been symptomatically cured, notwithstanding the persistent failure in gastric juice. Her weight has been increased, and now fluctuates between sixteen and twenty pounds more than when she first came under observation.

THE INFLUENCE OF ATHLETIC TRAINING ON BLOOD-PRESSURE.

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(From the Department of Clinical Medicine, University of Wisconsin.)

The present study was undertaken with a view of determining the influence of a specified period of training on the blood-pressure. Because of the availability of material for study, football was taken as the type of athletic training for investigation. The men reporting for varsity and freshman teams are required to receive a permit to train from the medical adviser, and the present blood-pressure study represents merely an enlargement of this routine.

Blood-pressure readings were taken by the auscultatory method preceding and succeeding fifty stationary running steps before and after the football season, and then in May after a period of rest. Uniform hours were selected for all cases to eliminate possible error from diurnal variations. The fifty steps were controlled by commands as to height and rapidity, the steps being completed in twenty-five seconds (MacKenzie). The systolic and the diastolic readings were made with the patient in the sitting posture, with a Faught mercury manometer. The pulse rate was taken by an assistant. Then with the arm band still in place the fifty stationary steps were taken and second readings were made. The method is doubtless open to criticism, but, even though crude, the uniformity of results bespeaks its comparative accuracy.

The data are complete in the main for forty-five athletes completing the football season. The data of sixty-eight men who either failed to complete the season's training or to report at the end of the season are added to render the average of men entering training more general. In addition to the blood-pressure statistics, we will endeavor to show what percentage of athletes start the season with cardiac enlargement, and what proportion develop this condition during their period of training.

A comparison of the blood-pressure and pulse rate before training in both groups A and B shows a close coincidence in systolic, diastolic, and pulse-pressure, and in the pulse rate before and after the test exercise. We may therefore conclude that the complete group B is a fair average of men entering the sport.[1]

For their average age, twenty to twenty-one, the systolic pressure of 118 mm. Hg., and the diastolic pressure of 82 mm. are relatively

[1] More complete data will be found in tables in reprint of this article.

high. Erlanger gives 100 to 110 mm. for the systolic and 60 to 70 mm. for the diastolic pressure at this age. A series of 20 non-athletic individuals in the University of Wisconsin[2] showed a systolic pressure of 111 mm. and a diastolic pressure of approximately 80 mm. The literature affords no normal reaction to test exercises.

In our present study the presence of an increase in the reaction of cardiac activity attendant on slight exertion is noted among athletes out of training as compared with non-athletes. The non-athletes shows only a 32 per cent. increase in cardiac rate on the exertion of fifty stationary steps,[3] whereas the average of the athletic groups is 45 and 44 per cent. It has been our observation that this condition pertains in a large proportion of athletes out of training. Pembrey and Todd[4] noted a similar reaction among men in training as compared with untrained, but offered no explanation.

From Group A the cases showing appreciable cardiac hypertrophy have been separated. Twenty-seven individuals (39 per cent. of the total) have this condition. The blood-pressure of these men coincides closely with the rest of the group.

The results of our observations on men completing their football training are compiled in Table I. For comparison the men are grouped according to increase, decrease, or stationary condition of blood-pressure; the number of individuals and percentages of the total these represent is stated along with change in millimeters of mercury. The pulse, systolic and diastolic phases of blood-pressure are grouped separately both before and after exercise, and in each of the periods, "after the season" is compared with "before season," "after a period of rest" is compared with "before" and "after season." These groups do not correspond to the large groups noted above. The total average increase or decrease for each phase of blood-pressure at each period is represented by the figures at the bottom of the table.

The total averages are probably better studied from the curves shown in Figs. 1 and 2. A normal curve is drawn for the blood-pressure before exercise, but as we have stated previously, no data are available for the normal reaction after exercise.

From Fig. 1 it will be noted that the systolic pressure of the athlete at rest before training averages 8 mm. of mercury higher than the resting non-athlete; the diastolic pressure is, however, 12 mm. higher in the average athlete. Therefore, the pulse-pressure in the resting athlete before the period of training averages 4 mm. less than the non-athlete. After the football training the following interesting condition pertains: The systolic pressure falls 6 mm., or to within 2 mm. of the normal, while the diastolic pressure fails to approach the normal line by 7 mm., not because there is not a fall relative to the systolic fall, but because of previous high diastolic

[2] Shumacker and Middleton, Jour. Am. Med. Assn., 1914, lxii, 1136.
[3] Ibid.
[4] Jour. Phys., 1908, xxxvii, 66.

TABLE I.—COMPARISON OF BLOOD-PRESSURE IN FOOT-BALL MEN COMPLETING TRAINING SEASON.

		After season compared with before season.						After period of rest compared with: Before season.						After season.					
		Before exercise.			After exercise.			Before exercise.			After exercise.			Before exercise.			After exercise.		
		Systolic.	Diastolic.	Pulse pressure.	Systolic.	Diastolic.	Pulse pressure.	Systolic.	Diastolic.	Pulse pressure.	Systolic.	Diastolic.	Pulse pressure.	Systolic.	Diastolic.	Pulse pressure.	Systolic.	Diastolic.	Pulse pressure.
Group A. Increased	Number of individuals.	11	11	21	14	16	19	28	26	22	22	18	19	35	30	20	24	24	21
	Percentage of total....	24.4	24.4	46.6	32.5	37.2	44.1	73.6	68.4	57.9	59.4	48.6	51.3	92.1	78.9	52.6	63.1	63.1	55.2
	Average in mm. of mercury.....	+5.0	+9.0	+6.0	+7.8	+5.7	+12.4	+9.8	+9.2	+7.8	+11.3	+7.5	+11.6	+12.5	+11.4	+7.7	+14.1	+8.5	+12.4
Group B. Decreased	Number of individuals.	30	28	21	25	22	21	8	8	13	12	14	12	2	3	12	5	7	13
	Percentage of total....	66.6	62.2	46.6	58.1	51.1	48.8	21.0	21.0	34.2	32.4	37.8	32.4	5.0	7.8	31.5	13.1	18.4	34.2
	Average in mm. of mercury.....	−10.0	−12	−7.3	−12.6	−13.9	−10.8	−5.5	−8.5	−8.6	−10.2	−11.0	−6.5	−13.0	−6.6	−6.2	−6.8	−4.8	−9.6
Group C. Unchanged	Number of individuals.	4	6	3	4	5	3	2	4	3	3	5	6	1	5	6	9	7	4
	Percentage of total....	8.8	13.3	6.6	9.3	11.6	6.9	5.0	10.5	7.8	8.1	13.5	16.2	2.6	13.1	15.7	23.6	18.4	10.5
Total Average	Increase (mm. of Hg.).	..	..	..	..	..	+1.0	+5.0	+4.0	+1.0	+4.0	+1.0	+3.0	+11.0	+9.0	+2.0	+8.0	+6.0	+2.0
	Decrease (mm. of Hg.).	−6.0	−5.0	−1.0	−4.0	−5.0													

pressure. With cessation of athletic training, both the systolic and diastolic pressures advance not only to, but beyond the ante-season records. This is a proportionate increase, and the pulse-pressure remains practically unaltered.

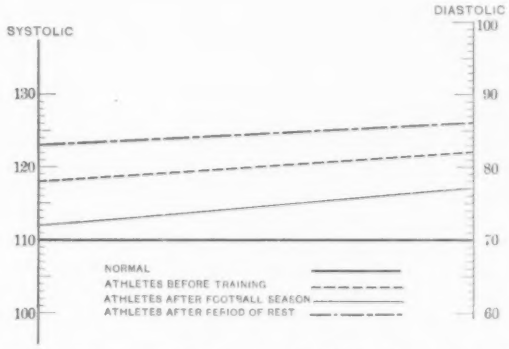

FIG. 1.—Total average blood-pressure in athlete before test exercise.

Fig. 2 indicates that the curves of blood-pressure after exercise follow the same general tendency of the systolic and the diastolic pressures of the resting readings at the corresponding periods. By this we mean that the "before training" curve occupies a position between the "after season" curve below and the "after period of rest" curve above, after exertion as well as in the resting state.

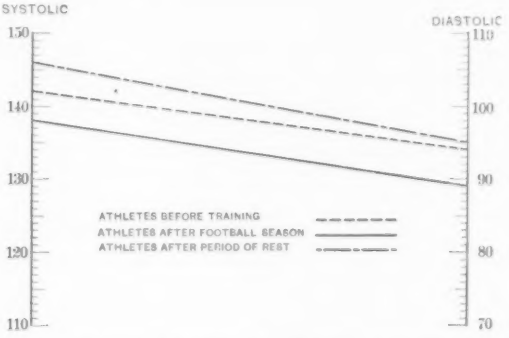

FIG. 2.—Total average blood-pressure in athlete after test exercise.

Of course, the diastolic pressure does not increase proportionately with the systolic pressure on sudden exertion.[5] This phenomenon leads to a marked increase in the pulse-pressure curves after exer-

[5] Lowsley, Amer. Jour. Phys., 1911, xxvii, 446.

tion, which, with the increase in pulse rate, is interpreted by Lowsley to mean augmentation with acceleration of cardiac activity. Before training, on exertion, the average systolic pressure increase is 24 mm. Hg., while the average diastolic increase is 12 mm. After their football training the average systolic increase is 26 mm. and the average diastolic 12 mm. After a period of rest the systolic pressure reaction to fifty running steps is 23 mm., while the diastolic increase averages 9 mm.

The possible relation between an increase in the skeletal musculature with a corresponding decrease in subcutaneous fat and these blood-pressure changes, *viz.*, the decrease of the systolic and diastolic readings with training, must be considered. Janeway[6] and Hensen[7] reported equal blood-pressure in arms of unequal size, and concluded that soft tissues played no important role in the blood-pressure readings. Von Recklinghausen's observations led him to the conclusion that with an arm band of 12 cm. or wider, soft tissues do not influence the blood-pressure readings. We followed the weight of twenty of the men through their training and found that no general rule could be applied; some men lost weight early in their training, but later regained the loss; some steadily lost while still others gained ground from the outset. There was no tendency on the part of those who lost weight to fall into a group of strikingly low pressure. On the other hand, gain in weight was no index for a rise in blood-pressure. As a matter of fact, while we assume that loss of weight being due to a combustion of subcutaneous and other stored fats to a large degree, and therefore assume that the removal of this tissue from the arms would lessen the resistance to compression, no confirmation could be found for such theory in even our most striking weight changes.[8]

CONCLUSIONS. The effects of a football training period on the blood-pressure are fairly constant, namely:

[6] Arch. Int. Med., 1909, iii, 474.

[7] Deutsch. Arch. f. klin. Med., 1900, lxxii, 443.

[8] As to cardiac hypertrophy, in Group A, 27 individuals of a total of 68, or 39 per cent., had an enlarged area of cardiac dulness before the training period. In Group B, 28 men out of 45, 62 per cent., showed hypertrophy before training. The discrepancy here is explained by the fact that for the greater part Group A are freshmen, while the majority of Group B are varsity men. After the football season, of 45 men completing their training, 40 had cardiac hypertrophy. Of the 5 men completing the season without cardiac enlargement, our examination in May revealed the fact that 4 of these had developed an appreciable enlargement in the interval, and the fifth had in the meanwhile been forced to withdraw from the University on account of a questionable pulmonary lesion; 3 of the men had, however, engaged in some other sport, making the relation between their football training and cardiac condition questionable. These figures would seem to indicate rather conclusively that cardiac enlargement of a rather moderate degree is the natural consequence of the football training. In addition there is an apparent tendency for the enlargement to the right to disappear, and in certain cases, for the reduction of left-sided enlargement. There can be no question but that these cases represent hypertrophy with moderate dilatation. The failure of the cardiac enlargement to disappear in the five months intervening between the end of football season and our last examination in May seems to be fair proof of the permanency of this condition.

1. A proportionate decrease in both systolic and diastolic blood-pressure during the training period.

2. With a period of rest succeeding the training period, a rise of systolic and diastolic blood-pressure beyond the anteseason records.

3. The blood-pressure reaction to the given test of fifty stationary running steps is scarcely altered by a period of training.

As a basis for explanation for these phenomena several hypotheses may be stated:

(*a*) *Vascular Influence.* The decrease of blood-pressure during training may result from an enlargement of the vessels to the skeletal muscles with lessened peripheral resistance. Or this lessened peripheral resistance may result from a compensatory vasodilatation to accommodate for the increase in cardiac output and work from athletic training. From the vascular stand-point the secondary rise of blood-pressure after a period of rest would be explained by the logical assumption of a return of normal vasomotor tone, which in the presence of a hypertrophied myocardium, or increased cardiac power, would lead to increased blood-pressure from a relative increased peripheral resistance with an accompanying increase in systolic output. Moderate peripheral sclerosis from overstrain would likewise give increased resistance with a tendency to higher blood-pressure than normally existed in a given individual.

(*b*) *Cardiac Influence.* The primary decrease in blood-pressure after a period of training may be the result of a temporary moderate cardiac dilatation. By regaining normal myocardial tone with rest and the development of cardiac hypertrophy the increase of blood-pressure during this period may be explained.

Perhaps both of these factors are active in the production of the phenomena.

THE ADMINISTRATION OF GLUCOSE SOLUTIONS AS A PROPHYLACTIC AGAINST POST-OPERATIVE SHOCK.

By A. C. Burnham, M.D.,
NEW YORK CITY.

In a recent article[1] the writer has called attention to the present status of our knowledge of the various methods of parenteral nutrition. From the experimental data cited, it is apparent that, theoretically and practically, an animal may be kept for a considerable period in nitrogen equilibrium and at a constant weight by the intravenous injection of solutions containing amino-acids and glucose (Henrigues and Anderson). The subcutaneous administration of fats is possible, and they are apparently metabolized and supply a portion of caloric need of the organism.

[1] Parenteral Nutrition and its Surgical Application, Med. Record, July 25, 1914.

For practical purposes, however, of the three main groups of nutritives—fats, proteids, and carbohydrates—only one (carbohydrate in the form of glucose solution) is available for the surgeon in the treatment of those accidents and disagreeable symptoms which may accompany, or occur shortly after, a major operation.

It is the desire, further, to emphasize the value of glucose solutions as a prophylactic against some of the unpleasant post-operative complications, as well as to call attention to the methods of its administration, that has led to the preparation of this article.

It may be stated as a postulate that patients who are well nourished stand operation better than patients who are poorly nourished. This is apparent to all, but the fact that patients are frequently underfed for a period of several days before operation is often regarded as of little moment. A patient who is well nourished has food material stored in his tissues to supply his requirements for a short period. This is principally in the form of glycogen and amino-acids, which are present in the liver and blood, and may be called upon in sudden emergencies. It is not sufficiently appreciated that after the first twenty-four hours these circulating and stored nutritives are largely exhausted, and after that time the body requirements are met almost wholly by the utilization of proteid and fat derived from the patient's own tissues.

It has long been recognized that starvation produces a condition known as acidosis, and that this same condition occurs after several days of a strict carbohydrate-free diet; or, pathologically, in patients suffering from diabetes who are unable to utilize the carbohydrates present in their food. The same condition also occurs in certain types of metabolic disturbances in children, in some cases of vomiting of pregnancy, and frequently after long anesthesia.

Acidosis should be recognized as a condition—not as a definite pathological process—the salient characteristic of which is the excretion of acetone bodies in the urine (and breath) and a marked increase in the titrable acid in the urine. It is commonly supposed that there is a condition of diminished alkalinity in the blood, but this statement has been challenged, the assertion being made that the blood is always neutral, and consequently a diminished alkalinity is impossible in that it is incompatible with life. The determination of the reaction of the blood is fortunately not essential for the comprehension of the clinical importance of acidosis. Whether the blood be acid, or alkaline, or neutral, there is in this condition a great decrease in available alkalies, and this, carried to the extreme, always ends in coma and death. Emerson has characterized the condition as "alkali starvation."

In the management of those diseases which are commonly classified as surgical, there are two conditions which are recognized as giving rise to acid intoxications, or acidosis. The most common type is that following anesthesia, which occurs to an appreciable

degree after from 30 to 60 per cent. of all anesthesias. The acidosis following starvation, as it occurs in those diseases associated with the inability to retain nourishment because of persistent vomiting, is not uncommon among surgical patients, and when it occurs is considerably less amenable to treatment than the uncomplicated post-anesthetic acidosis. The acid intoxication following both of these factors acting together has been found to be much more severe than that following either acting alone. That this is true is shown both by laboratory experiments and clinical experience. Experimental evidence points to starvation as the predominant factor in acidosis following prolonged vomiting, while, as was shown by Waldvogel, the toxic action of the anesthetic had an important influence in the production of post-anesthetic acidosis. Furthermore, it has been definitely proved that acidosis may be prevented or markedly diminished by the administration of carbohydrate food. The symptoms may be relieved by the use of alkalies, but the underlying disturbance is overcome only when sufficient carbohydrate food may be absorbed and oxidized to prevent the excessive metabolism of fats and proteids.

The effect of diet upon animals poisoned with chloroform was shown by the experiments of Opie and Alford in 1914.[2] If the conditions in the human body are comparable to those in animals, and there is every reason to believe that in this respect they are the same, then this work of Opie and Alford is of the utmost importance to every surgeon, and the inference which they draw as regards diet deserves far greater application than it has yet attained.

Animals (white rats) were fed for six days upon diets which consisted solely of either fat, proteid, or carbohydrate, and at the end of that time were given what was presumably the minimum fatal dose of chloroform injected beneath the skin. The results as given by Opie and Alford are shown in the following table:

LENGTH OF LIFE OF ANIMALS IN DAYS AFTER RECEIVING SPECIAL DIET FOR SIX DAYS.

Chloroform per 100 gm.	Diet: oats and sugar.	Diet: meat.	Diet: fat.
0.025	....	.....	L
0.05	L	11	3
0.1	10	L	1
0.15	L	L	1
0.2	L	3	2
0.25	L	3	2
Average duration of life	10+	5⅔+	1⅘

L = Lived.

From the above experiments, and others in which the results were confirmatory, Opie and Alford draw the following conclusion: "The experiments furnish evidence that fat administered to animals

[2] The Influence of Diet on Hepatic Necrosis and Toxicity of Chloroform, Jour. Amer. Med. Assoc., 1914, lxii, 895.

and presumably stored in the liver increases the susceptibility of the organ to the injurious action of chloroform. In view of the well-known solubility and diffusibility of chloroform in fats, they suggest that the fat of the liver cell determines the fixation of chloroform and occurrence of necrosis. The experiments with carbohydrates, on the contrary, furnish confirmation of the views of those who maintain that carbohydrates protect the body proteins from disintegration."

In the light of these experiments, as well as those of Waldvogel, it is important that patients about to be subjected to major surgical operations should, when possible, be put through a course of forced carbohydrate feeding for a short period immediately preceding the operation, and should receive carbohydrates in an available form soon after operation.

Secretan has called attention to the importance of giving food shortly before anesthesia as a prophylactic measure against post-operative shock. He asserts that it is usually safe to give some easily digested food from two to four hours before the anesthesia is begun. A patient in whom there is no contra-indication to oral feeding may be given a meal containing a considerable quantity of carbohydrate food in the shape of bread or cereal eight to twelve hours before operation, and a feeding which contains 100 to 200 calories in the shape of easily absorbable carbohydrate about three hours before the anesthesia is begun. In practice I have found that the latter is best accomplished by giving either six ounces of coffee or orangeade to which has been added one ounce of lactose. The above procedure should assure the organism of a considerable store of readily available glycogen during the period of anesthesia.

If we grant the plausibility of the argument up to this point it must necessarily follow that carbohydrate feeding should be instituted at the earliest opportunity after the operation. During the anesthesia, and for a period afterward, varying from a few hours to a few days in individual cases, oral feeding is impossible, so that we are, of necessity, forced to resort either to subcutaneous or rectal nutrition, or both. In the paper to which reference is made at the beginning of this article, the writer has discussed the various types of nutritives which theoretically may be used for subcutaneous nutrition, the conclusion being reached that glucose is the only form of nutritive which is clinically available for this purpose. Barlow recommended the subcutaneous use of glucose in 1895, and it has been in sporadic usage since that time; but it was not placed upon a scientific basis in surgical cases until the publication of Kausch, in 1911.

Sugar, in the form of glucose solutions, supplies energy to the cells and aids in tissue repair; it diminishes acidosis and thus tends to remove one of the factors in the cause of post-operative vomiting; it neutralizes certain poisons in the circulation (the conjugate glycuronates is the best example of this action); and it is possible

that it acts as a direct cardiac stimulant and food.[3] In addition to this, the solution introduced has many of the advantages and few of the disadvantages of saline solutions. Only a small percentage of the glucose injected hypodermically finds its way into the urine (usually from 2 to 5 per cent.). The remainder, as has been proved by the calorimetric experiments of Vezar and von Fejer,[4] is burned in the body, causing an increase in heat formation and a corresponding increase in the respiratory quotient.

Kausch[5] recommended 7 per cent. solutions intravenously and 4 to 5 per cent. solutions by hypodermoclysis. Solutions should be freshly prepared and sterilized, as they become more easily contaminated than does the ordinary saline. Strictly speaking, contamination is as easy in one as in the other, but owing to the fact that glucose is an excellent culture medium, accidental contamination is of more consequence than it is in common salt solution. Following the use of glucose by hypodermoclysis, there is no more pain or discomfort than after the injection of physiological salt solution. As much as two or three liters, representing from 90 to 210 grams of glucose, may be given during twenty-four hours, the amount depending on the character of the case and the urgency of the symptoms.

In addition to the hypodermic administration, glucose may be given by proctoclysis during anesthesia and for a period of several days after operation. It is given in 5 per cent. solution, dissolved in ordinary tap water, 12 to 16 ounces being introduced during the operation, and its administration continued, by the Murphy drip method, after the patient has returned to the ward. This method is so simple and has apparently been of such value that it should be used as routine after every severe major operation. From 300 to 500 calories a day may be introduced by one or both of the above methods without discomfort to the patient. This quantity, while insufficient to supply all the total energy requirement, is of great importance in the prevention of excessive nitrogen waste.

Three typical cases may be cited to illustrate the method of using glucose in routine practice.

Case I.—Male, aged twenty-four years. Well nourished. Operation for inguinal hernia. Sac adherent and operation prolonged. Twelve ounces of 5 per cent. glucose given by rectum as soon as patient returned to ward. Good recovery. Very little vomiting.

Case II.—Female, aged thirty-one years. Fairly well nourished. Acute appendicitis. Local peritonitis. Pulse rapid. Sixteen ounces of 5 per cent. glucose by rectum during closure of wound. Murphy drip, 5 per cent. glucose begun one hour after returning to ward. Good recovery. Very little vomiting.

[3] Gigon and Massini have brought forth arguments based upon laboratory findings which tend to prove that isolated muscle contains an enzyme by which it is enabled to utilize sugar directly, Biochem. Ztschr., 1913, lv, 189.

[4] Biochem. Ztschr., 1913, lii, 140. [5] Deutsch. med. Wchnschr., 1911, xxxii, 8.

CASE III.—Female, aged thirty-seven years. Poorly nourished. Pulse rapid. Removal of large ovarian cyst. Hypodermoclysis of four pints of 4 per cent. glucose during operation. Murphy drip, 5 per cent. solution after operation. Slow recovery.

In the above three cases glucose solutions were given simply as a routine procedure without regard to urinary findings or other symptoms of acidosis. In other words, it was given to those cases in which saline solution is ordinarily used as a prophylactic against post-operative shock.

Patients in whom a condition of acidosis may be suspected, should have a complete urinary analysis before operation, and if acetone be found, measures taken to diminish this condition as much as possible before operation is attempted. It should be remembered that these patients are poor surgical risks, and that, except in the most urgent cases, it is necessary to take measures to increase the available supply of fixed bases. This may be accomplished in two ways, namely, the administration of alkalies or of carbohydrates.

No attempt is made here to outline the complete treatment of acidosis, but it may be stated that it is customary to give an alkali in the shape of bicarbonate of soda until the urine becomes neutral. This will usually require much larger doses than are customarily given. Occasionally as high as 50 to 100 grams of sodium bicarbonate must be given before the reaction of the urine becomes neutral or alkaline.

In order to diminish the formation of acid bodies, large amounts of carbohydrate should be given, and it is exactly in those cases in which the administration of carbohydrates by mouth is impossible that the subcutaneous and rectal injections of glucose solutions find their indications.

The common conditions associated with acidosis are diabetes, nephritis, diseases of the liver, and after protracted vomiting. It is the last of these conditions that is seen most frequently by the surgeon and in which the administration of glucose plays its most important role.

Following operation, especially in the so-called "delayed chloroform poisoning," and in some cases which, for some reason, do not permit of oral alimentation, the urine should be carefully watched and at the first indication of acidosis, glucose solution and alkalies should be given either by mouth or rectum or directly into the circulation.

To recapitulate: (1) Glucose solution should be given as routine after every operation in which we have reason to fear more than the ordinary amount of post-anesthetic shock; (2) it should be given as routine in every case where post-operative oral feeding may be difficult or insufficient for a considerable period after operation; (3) it should be given as an emergency measure either before or after operation for the relief of an existing or threatened acidosis.

REVIEWS

OUTLINES OF INTERNAL MEDICINE. FOR THE USE OF NURSES. By CLIFFORD BAILEY FARR, A.M., M.D., Instructor in Medicine, University of Pennsylvania; Assistant Visiting Physician, Philadelphia General Hospital; Pathologist to the Presbyterian Hospital. Pp. 408; illustrated with 71 engravings and 5 plates. Philadelphia and New York: Lea & Febiger, 1915.

THE introduction of systematic courses in internal medicine in those hospitals which offer thorough theoretical as well as practical training to their nursing staff has made necessary the employment of a text-book upon the subject, which will deal briefly but comprehensively with internal medicine in all its important phases. To meet this need the present volume has been written, and, after a careful perusal of it, the reviewer feels that the need has been well met. The book has been carefully prepared; the essentials have been included, and the non-essentials have been omitted, so that persons desiring a knowledge of the rudiments of internal medicine may read with the assurance that what they read is of importance, that nothing of importance has been left out in the description of the individual diseases, and that if they remember what they read they will have a fitting frame-work, upon which to hang the prints of deeper, more elaborate study, when essayed.

The work is divided into ten parts, dealing respectively with the diseases of the various systems, the disorders of metabolism, the diseases due to physical causes and poisons, and the diseases due to animal or vegetable parasitic causes. Each part is preceded by a section dealing with general considerations and symptomatology of the diseases peculiar to the system under consideration. This is an especially valuable addition to the book, because it smoothes out the way for the beginner before she enters upon the rough road that leads to the knowledge of the special diseases. Each of these, in turn, is treated under the subheads of symptoms and treatment while the more frequent and more important diseases also have subheads of causes, course, complications and prognosis. In this way practically nothing is forgotten or omitted that is likely to be of importance to the future graduate nurse.

But few criticisms may be made of the book; it might seem well to omit nearly all references to physical signs, to delimit drug therapy to general terms, and to cut out entirely case reports or

case illustrations. Typhus fever, incidentally, should be more properly grouped under the diseases disseminated by body lice than those carried by ticks, as the latter animal's habitat is the country, while its cousin, the louse, is found where men congregate together in large numbers. Taking it all in all, however, the book stands as a careful, conservative, practical, abbreviated, treatise upon an extremely important subject. J. H. M., Jr.

Progressive Medicine. A Quarterly Digest of Advances, Discoveries and Improvements in the Medical and Surgical Sciences. Edited by Hobart Amory Hare, M.D., Professor of Therapeutics, Materia Medica, and Diagnosis in the Jefferson Medical College; Physician to the Jefferson Medical College Hospital, Philadelphia, etc.; assisted by Leighton F. Appleman, M.D., Instructor in Therapeutics, Jefferson Medical College, Philadelphia, etc. Vol. I. March, pp. 382; 15 illustrations. Vol. II. June, pp. 445; 100 illustrations. Philadelphia and New York: Lea and Febiger, 1915.

With the March number appears the first of the volumes of *Progressive Medicine* for this year. The contents of this volume embrace a wide range of subjects of unusual interest. The general surgical section consists of an article on the surgery of the head and neck by Charles H. Frazier, than whom there is no one better qualified to deal with these subjects of ever-increasing surgical importance, and one on the surgery of the thorax, a topic of great present-day interest, written in his usual scholarly manner by George P. Müller. The enormous amount of work constantly in progress on the infectious diseases is strikingly brought out by John Ruhräh in an admirable contribution of 145 pages, which embraces almost the entire range of the acute infections. In an article of about 25 pages, Floyd M. Crandall points out the important advances that have been made of late in pediatrics, particularly emphasizing diseases of the heart in children, acidosis in infancy, and recurrent sibilant bronchitis. In an exceedingly painstaking and thorough manner George B. Wood discusses recent contributions to rhinology and larynology. As is but proper, the accessory sinuses of the nose and the tonsillar tissues claim a large share of his attention. Truman Lawrence Saunders reviews the problems of otology with nice critical judgment, thereby furnishing a most instructive concluding article for this excellent volume.

The June issue of *Progressive Medicine* is always one of the most interesting and important volumes of the year. With the subject

of hernia discussed in all its varied phases by William B. Coley; with the ever-increasing problems of the surgery of the abdomen dwelt upon in all their many details by such a critic as John C. A. Gerster; and finally with an authority of such prominence as John G. Clark emphasizing the advances in gynecology that have occurred during the past year, it is small wonder that the first half of this volume offers the reader a wealth of surgical information that is indispensable. From the medical stand-point the volume is of no less interest, thanks to the usual able contribution by Alfred Stengel, who first reviews diseases of the blood, particularly leukemia and pernicious anemia, then takes up the absorbing subject of diseases of the thyroid and other ductless glands, and concludes with a discussion of diabetes, gout, and scurvy. Edward Jackson's concise but well-written review of ophthalmological advances is the concluding contribution to this really noteworthy volume. G. M. P.

THE ORIGIN AND NATURE OF THE EMOTIONS. By GEORGE W. CRILE, M.D. Philadelphia and London: W. B. Saunders Company, 1915.

THE reviewer has found this well-printed book difficult to review. The views therein presented are extremely speculative, and at times so arbitrarily verbal that the reviewer has not always felt certain that the author really means what he says. Dr. Crile lays stress upon certain histological appearances described as occurring in cells of the central nervous system under conditions of disease, fatigue and experimentation. In the interpretation of these findings he makes free use of the modern concepts of internal secretion of the several ductless organs, associating them in a schematic relationship to the brain, liver, and muscular system. By means of these speculations, supported by experiments that often do not bear upon the actual question at all or permit of several interpretations, hypotheses are erected purporting to explain about everything in the domains of psychology, physiology, and pathology. The histologic changes described in the cells of the central nervous system are not commonly regarded as possessing the unequivocal quality that is here ascribed to them. The reviewer has been advised by competent neurohistologists that the methods, results and interpretations are, to say the least, still under discussion. Concerning the influences of the internal secretions of the ductless glands, the literature is today in a state of extreme confusion and contradiction, and upon the published data one could erect several incompatible systems and not be able to prove or disprove any of them. Dr. Crile generally avoids discussion of the conceptions of other workers in this field; he selects from the mass what suits his

hypothesis and leaves the rest without comment. In fact, naivety is one of the characteristics of the book, previous work of competent investigators being often entirely overlooked and statements of familiar biological fact uttered as though they were original promulgations. Anyone who feels that this stricture is too severe is requested to make the following test: The chapter entitled "A Mechanist View of Psychology" is first to be read. After this are to be read the following, bearing in different ways upon the problem: Loeb, "Mechanistic Conception of Life" (tropisms are not discussed by Dr. Crile); Mach, "The Analysis of Sensations;" Singer, "The Pulse of Life" (*Journal of Philosophy, Psychology, and Scientific Methods*, xi, 645); and Bertrand Russell, "Our Knowledge of the External World." Following this the chapter on the "Mechanistic View of Psychology" is to be re-read. The result will be illuminating. Possibly it was with the work of Loeb (and other workers in comparative psychology), in mind that Dr. Crile expressed the hope that "we dispossess ourselves of the shackles of psychology." The extreme discursiveness of the presentation cannot fail to impress the critical reader unfavorably. If the opinions expressed in the mechanistic view of psychology are correct, the systematic psychologists of all schools are, for the largest part, in the wrong, including Spencer and Bergson, who owe so much to the theory of evolution. It is, of course, possible that this is true; but judged by the evidence presented in this book, it is highly improbable. The familiar German expression, Wer Vieles bringt wird Jedem Etwas beingen, seems here to have been paraphrased to the effect that if one attempts to explain everything one is sure to explain something.

The statement that "love is a phylogenetic conjugation without physical action" deserves literary immortality, and indicates that Freud has overlooked something. A futurist definition of humor is contained in the following: "A common example of the same nature is that encountered on the street when a pedestrian slips on a banana peel, and, just as he is about to tumble, recovers his equilibrium. The onlookers secure relief from the integration to run to his aid by laughing. On the other hand, should the same pedestrian fall and fracture his skull, the motor integration of the onlookers would be consumed by rendering physical assistance; hence there would be no laughter." One wonders what would be the physiological situation of the onlooker who, in the event of the man not falling, finds nothing to laugh at? On page 131 the statement is made that the victim of a high-speed bullet feels no pain because his remote ancestors had not developed response to fast-moving stimuli. "There was no weapon in the prehistoric ages which could move at the speed of a bullet from the modern rifle, therefore, while slow penetration of the tissues produces great pain and muscular response, there is no response to the swiftly moving bullet." While this

realization is doubtless a source of great comfort to the unfortunate men now charging trenches in Europe, mingled with feelings of pity for their descendents who may not be thus insensible, one wonders why fear alone is invoked to explain the lack of pain in Livingstone while struggling with a lion; why might not this also have been due to the fact that his prehistoric ancestors had not struggled with lions? In each instance one of several possible variables has been arbitrarily selected, and this in the face of the fact that any form of mental preoccupation, or stress of excitement, may expell the sense of pain from consciousness. The psychology of color sensation is disposed of in the following business-like fashion: "For example, each variation in speed of the light-producing waves of ether causes a specific reaction in the brain. For one speed of ether waves the reaction is the preception of the color blue; for another, yellow; for another, violet." In what the reaction consists is apparently an immaterial detail. In discussing the relations of the outpour of emotions to "phylogenetic experience" (there are here and there in this chapter expressions that remind one of Gertrude Stein) is the following: "The emotions, then, are the preparations for phylogenetic activities. If the activities are consumed, the fuel—glycogen—and the activating secretions from the thyroid, the adrenals, the hypophysis are consumed. In the activation without action, these products must be eliminated as waste products, and so a heavy strain is put upon the organs of elimination." Where has it been shown that the products of the ductless organs are eliminated after the fashion of urea, or that this elimination is a heavy strain? The problem of consciousness—unsolved from Socrates to Royce—is elucidated in the following statement: "We have shown that the effects upon the body mechanism of the action of the various ceptors is in relation to the response made by the *brain* to the stimuli received." "What is this power of response on the part of the brain but consciousness?" The most absolute mechanist can ask for nothing more positive than the following: "If our premises are sustained, then we can recognize in man no will, no ego, no possibility for spontaneous action, for every action must be a response to the stimuli of contact or distant ceptors, or to their recall through associative memory." A purely mechanistic conception, truly (a cross between evolution and internal secretion); but there will still remain considerable difference of opinion concerning the details of the *modus operandi*. Contrasted with the phylogeny of Dr. Crile, the *deus ex machina* of the eighteenth century was a tyro. In another place Dr. Crile selects his company as follows: "Such is the stimulating force of tradition that many who have been educated under the tenets of traditional beliefs will oppose these hypotheses—even violently it may be. So they have opposed them; so they opposed Darwin; so they have opposed all new and apparently revolution-

ary doctrines." In view of the rather shabby treatment accorded to the Darwinian theory of natural selection at the Darwin aniversary dinner a few years ago, the friends of Darwin will feel glad that he has been rediscovered, though they may object to the crude and arbitrary manner in which the doctrine of evolution is applied to physiology and psychology.

Dr. Crile's views on fever are in some points contrary to the data of the literature, in other respects hypothetical and unproved. "Fever invariably and chills, often, accompany the course of the infections." This statement is simply incorrect. "We must infer, therefore, that the fever is an adaptation on the part of the host for dispatching the enemy," is stated with reference to the work of Bass in the study of the malarial parasite. Bass, in his recent lectures on malaria in Philadelphia, did not interpret the fever as a combatative measure, but rather as the result of the liberation of metabolic products upon the part of the parasites. "Bacteriology has taught us that both heat and cold are fatal to pathogenic infections." Naturally a certain degree of heat is fatal. But there is no adequate warrant for the statement made that "Bacteriologists have taught us that bacteria grow best at the normal temperature of the body, hence fever must interfere with bacterial growth." For a few germs it has been shown that under the abnormal conditions of growth in the culture tube, growth is more rapid at 37° than at 40°. But there is no demonstration that in the infected body, bacteria grow less well at 40° than at 37°. "In fever, then, we have diminished intake of energy (or may have) but an increased output of energy —reviewer; hence the available potential energy of the body is rapidly consumed." In this book, as elsewhere, Dr. Crile confuses increase of body temperature with increase of heat production, apparently regarding the terms as synonymous, in the sense that increased heat production always accompanies fever. This convenient, though erroneous, assumption has led Dr. Crile in his researches to replace the measurement of heat (by direct or indirect calorimetry) by the simple use of the clinical thermometer. No consideration is given to the point of view, now under investigation, that fever may accelerate the formation of antibodies, using the term in its general sense. One is surprised to read so much of the body reactions to infections without references to immunology.

Unusual stress is laid upon considerations relating to acidity in the body, since "one would expect, *prima facie*, that the normal reaction would be altered by kinetic activation." A list of natural and experimental conditions are named in which it is asserted that the concentration of the hydrogen ions in the blood is increased beyond the range of normal variation. The experimental states described may nearly all be regarded as physiological dissolution. Indeed, Dr. Crile asks whether we may not regard acidosis as the actual final cause of death. No figures are given, no methods de-

scribed, these being reserved for a future publication. The chapter devoted to this subject opens as follows: "Alkalis and bases compose the greater part of the food of man and animals, the blood in both man and animals under normal conditions being slightly alkaline or rather potentially alkaline; that is, although in circulating blood the concentration of the OH-ions—upon which the degree of alkalinity depends—is but little more than in distilled water, yet blood has the power of neutralizing a considerable amount of acid (Starling, Wells)." Henderson, who should have been quoted in this connection, would give an accurate and much more lucid definition, without the totally meaningless statement that "alkalis and bases compose the greater part of the food of man and animals." With all that is now known of the relations of phosphate and carbonate to the neutralization of acid, of the basic and acid capacities of the blood and tissues and the relations of the concentration of the hydrogen ion to these factors as variables, only confusion is introduced by such a statement as "since at the point of death the blood is always acid, we may infer that some mechanism or mechanisms of the body were evolved for the purpose of changing bases into acids that thus energy might be liberated." Dr. Crile even speaks of the minute alkalinity of adrenalin as being of therapeutic importance. A study of the data bearing upon acid production in the body indicates that there are three degrees or stages in acid production; in the first, the acid formed in the body is neutralized by available labile cations and ammonia, with normal reaction of the blood; in the second, the body yields fixed cations, ammonia and sodium from the bicarbonate of the blood, with normal reaction maintained; in the third, the production of acid is in excess of maximum, chemically available cations, and the hydrogen ion concentration of the blood is increased. These stages naturally merge; the first is of physiological occurrence; the second is common in disease; the third stage has been very rarely observed outside of the state of dissolution. Acid production in the body is, therefore, not a qualitative but a quantitative process. Within the last ten years many estimations of the concentration of hydrogen ions in the blood have been carried out by measurement of the electromotive potential. There are two as yet unsolved methodic problems connected with the technical procedure, and one is not yet in the position of drawing fine distinctions, since the results are not yet reproducible to within one or even two millivolts. The existing data, in figures, indicate that outside of the state of dissolution, appreciable increase in the concentration of hydrogen ions in the blood and tissues is very rare. Many cases of diabetic and uremic coma, stated by Dr. Crile to present demonstrable acidity as their essential abnormality, have been determined to present values lying within normal ranges. Normal figures have been found also in exophthalmic goitre. In a few instances of terminal diabetic coma, just before death, in pro-

found narcosis, and in extreme stagnation of carbon dioxide, slight but demonstrable increase in concentration of hydrogen ions has been observed. Allowance may also be made for the occurrence, especially in young children, of sudden flooding of the body with acid, since the metabolism of the child seems to possess a power of neutralization more limited than in the adult, relatively and absolutely. But beyond this, the statements made by Dr. Crile of the widespread occurance of demonstrable acidity are not borne out by the measurements in the literature, measurements carried out by numerous workers trained in physicochemical research. In the discussion of diabetic acidosis no mention is made of the ketonic acids; diabetic acidosis is lumped with the others. Standing upon the hypothesis that acidosis is the cause of anesthesia both induced and natural in the state of coma of disease, he states that "a reason is supplied for the use of intravenous infusions of sodium bicarbonate to overcome the coma of diabetes and uremia." The numerous physicians who, following the advice of the Naunyn school, have used alkali in the treatment of diabetic coma on the assumption that the ketonic acids formed in this disease were being combined with cation and the body spared its cations, will now feel grateful that a reason for this procedure has finally been discovered. Why alkali should be necessary at all, however, still remains unclear, for we are informed that "water, like air, neutralizes acids." That uremic and diabetic coma should thus be classed together, with our present knowledge of the relation of ketonic acids to diabetic coma and our complete ignorance of the chemical cause of uremic coma, is little less than amazing. Extreme variations of behavior seem to be exhibited by acidosis within the confines of the relatively small state of Ohio. In Cleveland, acidosis causes anesthesia; in Cincinnati, acidosis causes edema. And under the circumstances, one would naturally expect in this book some reference to the work of Fischer.

In every chapter of the book the boundless enthusiasm and engaging personality of the author are in evidence. The reader must be critical, because the author is uncritical. The attempt to expound physiology and psychology phylogenetically is not new. This particular method of attempting the demonstration is individual to the author. The reviewer does not presume to suggest that demonstration may not in future be effected; he is certain that it is not accomplished by the data and hypotheses presented in this book. The words of Russell, applied (unjustly in the opinion of the reviewer) to evolutionism as a total movement, apply to Dr. Crile's evolutionism of the emotions: "Evolutionism is rather to be regarded as a hasty generalization from certain rather special facts, accompanied by dogmatic rejection of all attempts at analysis, and inspired by interests which are practical rather than theoretical."

A. E. T.

PROGRESS

OF

MEDICAL SCIENCE

MEDICINE

UNDER THE CHARGE OF

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Leukocytosis in Dementia Precox.—ZIMMERMAN (*Ztschr. f. d. ges. Neur. u. Psych.*, 1914, xxii, No. 3) made examinations on 50 cases of dementia precox in various stages of the disease. In 96 counts there was leukopenia 41 times and an increase in the white cells 46 times. Normal values were seen in only 9 or 10 per cent. Quantitatively the findings point to an increase in the mononuclear elements generally at the expense of the neutrophilic cells. The eosinophiles may reach 10 per cent. or over and the large mononuclears 11 to 15 per cent. Monocuclear elements are frequently 30 to 40 per cent., and even reached 60 per cent. In one instance the formula was: small mononuclears, 71 per cent.; large mononuclears, 5 per cent.; polymorphonuclears, 22 per cent. With a relative leukocytosis there is always a lymphocytosis. This was absent in only one instance. Generally the increase in small lymphocytes is not very much over the normal, but may be marked. In two-thirds of the cases there was pronounced eosinophilia and occasionally a moderate basophilia. In any case the lymphocytes, large mononuclears, and eosinophiles show little variation, while the total white count may vary a great deal. These findings are of no prognostic value. Eosinophilia was most marked in cases showing outspoken dementia.

Newer Protein Reactions in Spinal Fluid: Their Value and Relation to Antibody Content.—KAFKA and RAUTENBERG (*Ztschr. f. d. ges. Neur. u. Psych.*, 1914, xxii, 4–5), using sufficiently high serum titre, found in spinal fluid of general paretics hemolytic amboceptor for sheep's red cells in dilutions of $\frac{1}{20}$ to $\frac{1}{2}$, independent of the globulin reaction, total proteins, and cell increase. These are only found in cases of cerebral

lues when there are meningitic symptoms as shown by cell increase, increase in total proteins, globulin fraction, complement content, and coagulability. As in acute meningitis the amboceptor goes away as the inflammatory process subsides. There exists no marked parallelism between protein and hemolysin reactions. Kafka and Rautenberg represent these by a numeral in which the numerator indicates the antibody value, the denominator the strength of Phase I or the total proteids. In general paresis the number is greater than 1. In fluids from cases of general paresis a clouding occurs even at 30 per cent. saturation with ammonium sulphate, and in cases of acute meningitis a similar result occurs with 28 per cent. This protein fraction bears some relation to the amboceptor content. Quantitative proteins were determined with Nissl's method. Kafka and Rautenberg consider that Phase I offers the best guide to the influence of treatment.

The Action of Various Lipoids Isolated from the Endocrine Glands.—Iscovesco (*Comp. rend. de l. Soc. d. Biol.*, 1913–14, lxxv and lxxvi). *Ovaries:* The lipoid found in ovarian tissue is the same in all animals and possesses the property of stimulating the ovaries and especially the uterus, and calling forth their hypertrophy. This lipoid, moreover, stimulates the thyroid, and has some regulating influence and hastening actions upon the growth of young individuals. *Testes:* Dogs were injected every other day in the cervical region with a lipoid made from testes. Such injections excite the testes very markedly, probably through centres in the spinal cord; the thyroid and kidneys are weakly stimulated. It stimulates growth in young animals while grown ones increase considerably in weight. Similar results are seen in man when given 2 c.c. of the lipoid subcutaneously every day. *Adrenal Cortex:* Lipoids from the cortex stimulate the medulla of the gland markedly, the liver and kidneys very little. It has a strong irritating action upon the skin; in man it causes tachycardia and hyperhidrosis; daily injections of small amounts increase the general condition. *Adrenal Medulla:* This lipoid shows properties very different from those of the cortex. It is a mild stimulant to the adrenal and heart. Daily injections in man cause bradycardia and increased blood pressure. It makes the individual feel remarkably well and ready for work. From these observations Iscovesco thinks that in Addison's disease the asthenia, cardiac and vascular symptoms are due to medullary changes and the pigmentation results from primary or secondary changes in the cortex.

Biological Studies on Eosinophilia.—This report of Weinberg and Séguin (*Ann. de l'Inst. Pasteur*, 1914, xxiii, 470) deals with the production of local eosinophilia by means of eosinophilotactic substances, given to untreated and immunized animals, as well as the relationship between local and blood eosinophilia and anaphylaxis. "Local eosinophilia" was studied in the lids of horses after a few drops of the body fluid of Ascaris megalocephala had been instilled into the eye. Following this, resection of the lids occurred at intervals of from a quarter of an hour to ninety-six hours, and this material was studied histologically. Eosinophiles are found out in the connective tissues of the conjunctivæ as soon as a half an hour after the instillation and at this

time the capillaries are filled with polynuclear cells of all kinds. The chemotaxis for the eosinophiles disappears rapidly. The degree of the local eosinophilia is due not merely to the reagent employed, but depends as well upon the eosinophilic content of the animals' blood. Thus, if the latter is low, the local reaction consists solely of an outpouring of neutrophilic leukocytes. There are no substances as yet known which are purely chemotatic for eosinophiles. Similar changes were observed in guinea-pigs injected subcutaneously or intraperitoneally with the fluid from hydatid cysts, or the watery extract of sclerostoma. Of 150 pigs only 7 failed to show eosinophilia following intraperitoneal injection. Guinea-pigs given two or more injections show an increased chemotaxis as a result of this immunization, and numerous eosinophiles can be found in the peritoneal exudate of such animals, tending to show that there is developed a genuine specific reaction to the substance injected, since these animals react, as do normal ones, to the injection of chemotatic substances other than those used for immunization. It can be shown clearly that local eosinophilia occurs at the expense of the eosinophilic content of the circulating blood; the decrease in the blood is most pronounced in immune animals. Pulmonary eosinophilia, which is regarded by some as a characteristic injury in anaphylaxis, occurs normally in most guinea-pigs with well developed blood eosinophilia. The rise that occurs in sensitized animals is not the result of anaphylaxis, but is due to the direct action of the antigen upon the blood-forming centres, which have been sensitized by the primary injection.

Paroxysmal Tachycardia.—Duhot and Boez (*Province méd.*, 1914, xxvii, 260) deal with the history, illness, and autopsy findings in two cases of paroxysmal tachycardia. One came under treatment by reason of numerous short attacks, the other by reason of anginal seizures. A full discussion of the condition is given as well as the theories of its causation. The original view that it is a purely nervous phenomenon is now replaced by the conception of the disease as being a purely cardiac one. The patients characteristically complain of something being out of order in the breast, and this occurs in association with a pulse rate of about 200, an embryonic rhythm, and a fall in blood-pressure. During the seizures one may observe oliguria, albuminuria, and even glycosuria. There are usually present pallor, hyperhidrosis, vomiting, and anisocoria. Very often marked dilatation of the heart occurs during the attack, which may last a few minutes or persist over a week. Suddenly the heart returns to its normal rate, though frequently there are extrasystoles for a while. Once in a while the attack may set in and end in a slow manner. The frequency of the attacks is extremely variable. Duhot and Boez describe three forms: (1) the abortive; (2) a type characterized by long periods of remission; and (3) a progressive type. They consider the prognosis bad in the last two forms. Of etiological moment are diseases of the heart, heredity and a neuropathic constitution, while the exciting factors of the attacks are many, such as psychic traumata, dreams, overexertion, digestive upsets, the onset of puberty, menopause, etc. Infections play a role, and especially rheumatic fever. The nervous system has been held accountable, first by a paralysis of the vagus, then by some process involving the

cardiac centre and finally by assuming an undue stimulation of the accelerator nerves. Electrocardiograms show that the excitation does not arise in the node of Keith and Flack, but from an intermediate point in the auriculoventricular system; hence the disorder is a functional one of the primitive bundle. section or compression of which causes the Adam-Stokes syndrome. Treatment is directed toward stimulating the vagal fibers, by compression or electrical stimulation, bodily and mental rest, bromides, morphine, and the digitalis bodies. All forms may be useless.

A Modification of Typhoid Vaccine.—K. KISSKALT (*Deutsch. med. Wchnschr.*, 1915, xli, 393) points out the fact that the lower the temperature at which typhoid bacilli are killed, the greater is their antigenic power. In preparing typhoid vaccine, the bacilli after being killed are usually preserved in 0.5 per cent. carbolic acid solution. It occurred to the author to omit the application of heat altogether and to kill the bacilli by the addition of 0.5 per cent. carbolic acid. He found that one strain of typhoid bacilli was killed within twenty-four hours by the acid; six strains were killed in forty-eight hours; three strains in thirty-six hours. A suspension of cholera bacilli was destroyed in twenty-four hours. By placing the suspension of bacilli in the incubator at 37° C., death of the bacilli occurred within one day. Under these conditions, 0.25 per cent. carbolic acid kills the cultures relatively quickly. Since some cocci are not killed, and may even grow in 0.5 per cent. carbolic acid, careful technic is absolutely essential. Subcultures, of course, are made to determine that no organisms are living before employing the vaccine. By means of vaccine procured in this way, the author believes it may be possible to secure efficient results with smaller doses of vaccine. He purposes to investigate this question as soon as material is available.

On the Treatment of Leishmaniosis.—G. DI CRISTINA and G. CARONIA (*Deutsch. med. Wchnschr.*, 1915, xli, 396) say that the mortality of infantile leishmaniosis is very high, recoveries amounting to only seven to fourteen per cent., and these are apparently spontaneous and not dependent upon treatment. The authors, therefore, decided to try tartartus stibiatus intravenously, which Vianna had found so useful in the tropical venereal ulcer and the skin ulcer of Brazil, each due to Leishmania. Their method of treatment is as follows: Every second day an intravenous injection of a 1 per cent. aqueous solution of tartartus stibiatus is given, the minimum dose being 2 cg. increasing to a maximum dose of 10 cg. The authors have treated ten cases. Two of these were in the last stages of the disease and died. Of the remaining 8 cases, 5 are cured, 2 are improving under treatment, and 1 died of an acute nephritis which developed after an initial improvement in the patient's condition. It was impossible to determine whether the nephritis was the result of antimony poisoning. The total dosage given the cured cases varied between 25 and 84 cg. The general condition of the patient improves quite rapidly after beginning the treatment, and there is also early improvement in the condition of the blood. The number of parasites found in the spleen steadily diminishes, and, finally, they disappear entirely.

SURGERY

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Empyema of the Thorax.—WILENSKY (*Surg., Gynec., and Obst.*, 1915, xx, 50) presents a critical study of 299 cases of acute empyema of the thorax treated at the Mount Sinai Hospital, New York, in the last ten years. More than one-third of the cases occurred in the first two years of life. In the first year, 48 per cent. of the cases were lost; in the second year 31 per cent.; and in the third year 41 per cent. For the rest the average mortality was about 18 per cent. The youngest patient was five weeks old and the oldest sixty-four years, and both recovered. Sixty-six per cent. of the cases followed lobar or bronchopneumonia. In 33 per cent. the empyema occurred as a primary disease. In 2 to 3 per cent. of all the cases, the empyema appeared as a secondary focus to some inflammatory lesion in a distant part of the body. It occurred in the bacteremias, usually of the staphylococcus or streptococcus groups; also after infections of the pharynx and tonsils; after appendicitis, either with or without abscess formation; or after purulent inflammations of the uterus and adnexa occurring in the puerperium or independent of it; after a hemorrhoid operation; and after an infected vaccination ulcer. About 2 per cent. of the patients had both pleuræ involved and many of these died. Wilensky says that whatever the cause of the empyema, the pleural cavity is entirely involved in the majority of cases. No adhesions may be present and the pus may circulate over all the lung surfaces between visceral and parietal pleura. The cases studied are from the records of the hospital and it is not stated that this view is based upon personal observations or upon other authority. According to this conception the dulness in the usual empyema should move as freely as in ascites, which is not in agreement with common experience; and the simultaneous opening on both sides of a double large empyema should be followed by a rapid total double pneumothorax, which is not in accord with Hellin's extensive statistical study and more recent literature. Aseptic purulent exudates are uncommon. A certain number of cases were caused by anerobic bacteria. Murphy's formalin injection method of treatment was tried in 7 cases. Two of these died and 3 are reported as not improved. The largest number of the cases stayed in the hospital only from three to four weeks. It was not stated, however, that the sinuses were closed when the patients left the hospital.

The average mortality for the series was 28 per cent., varying from 50 per cent. in infants to 18 per cent. in adults. The least unfavorable period is between three and ten years of age. Twenty per cent. of the patients die as the result of the primary illness, or of a recurrence of it, or of some other complication or intercurrent disease. Only 8 per cent. die because of the empyema, and half of these die in the first forty-eight hours. Twenty-three per cent. of the patients that recovered had more or less trouble with the healing of their wounds—1 out of every 4.

The Use of Silver Foil in Surgery.—LEXER (*Zentralbl. f. Chir.*, 1915, xlii, 217) found silver foil very advantageous, especially, in wounds of the face and in skin transplantations. On the first change of the dressings, a week after operation, or when the sutures have been left three weeks or more under a cast, they are dry and show no surrounding inflammation, even in regions rich in perspiration. It was shown by bacteriological examinations that the sutures and surrounding parts remained sterile when covered by the silver foil. Eczema and maceration of the skin did not occur when the wound secretions were abundant and kept the dressings moist after delay in changing them. A striking feature is the fine smooth scar which is dependent upon the absence of infection. If the silver foil is washed away with benzin and the scar examined by a magnifying glass, three or four days afterward, the new epidermis is seen covering this scar smoothly from one edge of the wound to the other. This gives the sutured wound a better hold so that one may use very fine sutures. This is of special advantage in plastic operations on the face. The sutures may be removed after five days and the wound covered by more silver foil as long as a dressing seems necessary. Because of this rapid covering of the wound by the skin, Lexer employed the silver foil in skin transplantations and thinks there is no better method. Here, also, he employs only one layer of the silver, instead of four layers as by Halstead who introduced this method in 1894, and covers the silver with smooth sterile gauze. On the removal of the dressing at the end of a week the grafts are found healed. In some spots the epidermis is raised by blood or pus, as when granulations have been removed, but these spots are quickly covered by epidermis after the lifted parts are removed and the underlying granulations have been covered by silver foil. Lexer applied the method to granulating wounds and found that good smooth granulations developed and excess was prevented by the silver. Unhealthy granulations with much secretions were cleansed rather rapidly by the silver.

Treatment of Gunshot Wounds of the Abdomen by Compressing Bandages.—KELLING (*Zentralbl. f. Chir.*, 1915, xlii, 241) after calling attention to the high mortality of these cases and the associated conditions affecting the mortality, says that the first efforts of the surgeon should be directed toward localizing as much as possible the results of the injury to the gastro-intestinal tract. The patients should lie quiet and should be carried to the place for treatment. Scheibe reported that those who lay two or three days on the battle field, showed favorable results. Those wounded below the umbilicus

should have the upper part of the trunk raised, while those wounded in the epigastrium should have the pelvis raised. Those with gunshot wounds in the right or left flank should lie on the side injured, because gravity is of the first importance in localizing the escaped gastro-intestinal contents. Kelling urges the use of a compressing bandage of the abdomen. It will be most effective in those cases in which the wound is about in the middle of the abdomen. It will be somewhat less effective in wounds of the epigastric or hypochondriac regions because it can only indirectly compress the space under the ribs above, by contracting the volume of the abdominal cavity. The pressure does not operate to force out the intestinal contents into the surrounding peritoneal cavity, but does quite the reverse. It allows no space into which escaping contents can find its way. Hemorrhage from wounded parenchymatous organs is affected in a similar manner. It is especially important, during transportation, to prevent or diminish changes in the position of the viscera which favor greater escape of intestinal contents, by the use of the compressing bandage. The method of treatment was tested, experimentally, in six large rabbits. The same wound was made on each of two rabbits, the compression bandage being employed in one and not in the other. In one of the first two rabbits, through a small epigastric incision, a 1.5 cm. opening in the anterior wall of the stomach was made. Fluid contents were allowed to escape, when the stomach was replaced, the wound in the abdominal wall closed and the compression bandage applied. The rabbit was killed by chloroform two days later and the section showed the whole abdominal cavity free of peritonitis. The incision ring in the stomach was adherent to the liver and omentum. The second animal, on which exactly the same operation was done, was killed after sixteen hours. General peritonitis with the intestines diffusely red and much fluid in the peritoneal cavity were found. The incision wound in the stomach was in no way adherent. The results in the other four rabbits were very similar. The employment of the compression bandage is most effective when applied immediately after the wound is received.

Ileus Duplex.—HANDLEY (*Lancet*, May 1, 1915, p. 900) presents a study of his observations of the pathology of this condition in the living. Ileus duplex is a condition in which, as the result of a pelvic peritonitis, there is obstruction of the intestine at two points: (*a*) in the ileum, at a point about 3 feet above the ileocecal valve, and (*b*) in the sigmoid colon at the junction of its iliac and pelvic portions. These are the points at which the ileum and colon respectively cross the brim of the true pelvis to enter the pelvic cavity. The segments of intestine paralyzed are two in number: (1) the portion of ileum contained in the pelvis, that is to say, about the lower 3 feet, excluding the last 2 inches; and (2) the portion of the large bowel contained in the true pelvis, *i. e.*, the lowest portion of the pelvic colon and the upper portion of the rectum. Three main reasons are given for its importance: (1) because the condition, though curable by appropriate treatment in the early stage, often passes unrecognized under the pseudonym of general peritonitis; (2) because the duplex nature of the obstruction has not hitherto been appreciated; and (3) because, as might be expected, defects in the pathological conception of the

condition have been reflected in imperfect treatment. And in this condition delayed or defective treatment means certain death. Handley has met with the condition fourteen times in some hundreds of abdominal cases of all kinds. The results show that forms of treatment which take into account only the small intestine element in the obstruction give a high mortality. Four out of six cases of simple ileocecostomy died. The two patients who recovered indicate that the large intestine obstruction besides being later in onset, may not always become complete. On the other hand he has no death to record among the three patients treated by ileocolostomy combined with cecostomy. This is the ideal treatment. It appears to matter little whether the anastomosis is made between the ileum and cecum or the ileum and sigmoid, provided in either case that a safety valve to the exterior is supplied by tying a catheter in the large intestine. The anastomosis with the cecum is safer because further removed from the inflamed area. Handley is prepared to admit that a cecostomy is superfluous in a minority of cases but it cannot be safe to do without it. He concludes that peritonitis of the serous surface of the intestine, when it reaches a certain degree, is accompanied by complete paralysis of the involved segment of the intestine. General peritonitis means general paralysis of the intestine, and is accordingly not amenable to surgical treatment. But if the peritonitis is partial, though unlimited by any adhesion barrier, certain segments only of the intestine are paralyzed. If the paralyzed segments can be thrown out of circuit by surgical measures recovery is in such cases possible and even likely.

The Covering of Large Defects in the Skull by Means of Celluloid Plates.—FUNKE (*Zentralbl. f. Chir.*, 1915, xlii, 257) says that in all small defects of the skull the autoplastic is to be preferred above all other methods. It has certain disadvantages, however. For large defects it is almost impossible to form a single large bone shell to answer the purpose. Usually, it must be broken into several pieces which even when the dura is intact can give rise to troublesome deformity. Heteroplastic methods are best in such cases. Funke has employed celluloid plates in preference to metal plates, cork, hard rubber or horn plates. With careful asepsis and thorough hemostasis, the celluloid plates heal in without trouble in most cases and may remain many years, seven years (Hinterstoisser), eight years (Fräncke). Funke had one case, however, which showed that the celluloid plate underwent changes and did not maintain a firm position. The patient sustained a comminuted fracture of the parietal bone which required the removal of several fragments. Some weeks later when the patient had recovered sufficiently, Funke closed the defect in the skull with a celluloid plate 12 cm. long and 7 cm. wide. Later still a secondary operation was necessary to cover a portion of the plate exposed in consequence of tension on some of the sutures. Afterward it remained covered and gave no trouble for about ten years, when a small sinus developed apparently without cause, and discharged bloody serum. The sinus failed to close from conservative treatment and four months later a second sinus appeared. A few weeks after this an operation was done to remove the plate, which was found broken in several places. These overlapped each other accounting for a faulty closure of the original

defect in the skull. The consistency of the plate was now much changed. The pieces were thinner than the original plate, the smoothness of its surface had disappeared, the pieces were soft, had lost their elasticity, and could be rubbed away between the fingers. After thorough removal of the granulation tissue with a sharp curette, the wound was completely closed by sutures. The celluloid plate was originally 2 mm. thick, and it appears that about a year before the sinus developed, the plate had been fractured. At that time the patient was struck by a foot ball in the region of the plate, after which he experienced an unpleasant sensation until without further cause the sinus appeared. Six weeks after the removal of the celluloid plate, a gold plate, 15 cm. long and 9 cm. wide, was introduced and healed in without trouble. Celluloid offered a most useful material because of its firmness, and the ease with which it could be sterilized and modelled. We should strive to find another as useful material without its disadvantages. Funke thinks it may be found in juvelit produced by Fritz Pollak, of Vienna. It is made from phenol and formaldehyde.

THERAPEUTICS

UNDER THE CHARGE OF

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The Intradural Administration of Mercurialized Serum in the Treatment of Cerebrospinal Syphilis.—BYRNES (*Jour. Amer. Med. Assoc.*, 1914, lxiii, 2182) reports 32 cases of syphilis of the nervous system who have been treated by the intradural administration of mercurialized serum. Of the 32 cases, there were 13 of tabes dorsalis, 2 of taboparesis, 3 of cerebrospinal meningomyelitis, and 14 of general paresis. In general the cases of tabes and meningomyelitis have shown the most marked improvement although, in a few instances, general paresis has been distinctly benefited. The improvement in clinical symptoms has been similar to that observed in the Swift-Ellis method. In most of the cases of locomotor ataxia relief of the pains has been decided, the gait has improved, and gastric symptoms have been distinctly alleviated. The reaction following the administration of mercurialized serum is usually mild according to Byrnes. There is some pain in the legs for six or twelve hours, slight nausea, rarely vomiting, and a moderate rise of temperature. All of these symptoms generally subside within thirty-six hours. Byrnes has not observed the sphincter disturbances sometimes seen after the use of salvarsanized serum nor has there been any evidence of renal disturbance or other untoward symptoms. The technique for the preparation and administration of the serum is similar to that employed in the Swift-Ellis method, except that no drug is administered before withdrawing

the blood. Sufficient blood is withdrawn from the patient to yield from 12 to 30 c.c. of serum. After the blood has coagulated the serum is pipetted off and if necessary centrifuged for twenty minutes. If diluted serum is to be used, to 12 c.c. of the clear serum is added 1 c.c. of a solution of mercuric chlorid in freshly distilled water so made that each cubic centimeter contains one-fiftieth grain of mercuric chlorid. A sufficient amount of normal salt solution is added to the serum thus prepared to make a total volume of 30 c.c. If the concentrated serum is to be used the same quantity of mercuric chlorid is added to 30 c.c. of serum but there is no special reason for employing this concentrated preparation. Byrnes does not believe that mercurialized serum alone is the only treatment that is necessary in syphilis of the central nervous system, he is of the opinion that it is equally, if not more, efficacious than salvarsanized serum in the local treatment of these diseases. The immediate reactions following its administration are, in general, not so severe as those after the use of salvarsanized serum, and the cell count in the spinal fluid appears to be more quickly reduced. Since preliminary medication is not required, the blood may be obtained at any time; and because of the greater stability of the mercurialized serum it may be prepared at leisure and kept in sealed flasks until it is convenient to administer it. In certain cases of cerebrospinal syphilis, in which the serum Wassermann is negative but in which there are all the indication for intraspinal treatment, Byrnes thinks it unnecessary to subject the patient to the discomforts of an intravenous administration of salvarsan merely for the purpose of securing a preparation for intradural injection. This objection does not arise in the use of mercurialized serum. It is true that in many cases both the blood and spinal fluid show evidences of infection, and in such instances the intravenous dose of salvarsan cannot justly be withheld so that he has frequently given the combined salvarsanized and mercurialized serum intraspinally. Owing to the greater stability of the mercurialized serum Byrnes hopes that a method may be devised by which a permanent preparation can be dispensed in sealed ampoules and thus simplify the whole technique of intraspinal therapy. While it may be unwise to entertain the idea of using a foreign serum, it is not unlikely that human serum may be obtained in sufficient quantities for this purpose.

The Treatment of Tetanus.—Hochhaus, Kreuter, Rothfuchs, Alexander, Kühn, and Müller (*München. med. Wnschr.*, 1914, lxi, 2253–2260) write concerning their experiences in treating tetanus among the wounded. There is a great difference in opinion regarding the efficacy of various methods of treatment. Some report great benefit from magnesium sulphate while others have had no success at all with this method. Kreuter advocates the intravenous and intraspinal use of large doses of serum. Rothfuchs claims to have seen marked benefit from salvarsan in four cases. Alexander states that 8 of his patients, given 10 grams of chloral in a single dose each day, have all recovered while 2 died who received only 5 grams of chloral. This group of patients also received serum besides the symptomatic chloral treatment. Kühn and Müller advocate the use of luminal instead of chloral and other sedatives to control the convulsions. They speak especially of the sodium salt, which because of its solubility of water

can be used by subcutaneous injection. They believe it is superior to chloral in that it is less depressing to the heart. Müller has found hot baths to be serviceable in controlling the spasms. He has also made use of tracheotomy in some cases, and speaks of the great relief that may be obtained by this procedure.

Pneumothorax for Hemoptysis.—Von Adelung (*Boston Med. and Surg. Jour.*, 1914, clxxi, 200) says that the value of induced pneumothorax to control bleeding from the lungs is not sufficiently appreciated. The medical treatment involves considerable loss of time and subjects the patient to the unpleasant and often harmful by-effects of the drugs used. This is especially true of opium, the most valuable of the drugs used for hemoptysis. Pneumothorax, on the other hand, acts promptly and obviates the disadvantages of drugs. The change of pressure from negative to positive leads to the cessation of hemorrhage. By introducing a little more gas every few days the positive pressure may be maintained so that hemorrhage cannot recur. And meanwhile, unless otherwise contra-indicated, the patient may be allowed to go about instead of being confined to bed. For the purpose of inflation the author uses a portable apparatus modeled after Murphy's original apparatus. More recently Murphy has suggested a simple procedure for emergency cases which consists in introducing a hypodermic needle into the pleural space and allowing atmospheric air to be sucked in until the patient feels distress. The needle is dulled by rubbing it on a stone; a puncture of the skin is made with any sharp instrument. The boiled hypodermic needle is then inserted into the pleural sac, with its outer end covered by sterile absorbent cotton, which filters the air that passes in.

The Intraspinal Treatment of Syphilis of the Central Nervous System with Salvarsanized Serum of Standard Strength.—Ogilvie (*Jour. Amer. Med. Assoc.*, 1914, lxiii, 1936) being convinced of the value of the Swift-Ellis method, from observation of results in some 200 treatments, but believing that as in the employment of all other anti-syphilitic medication, the maximum efficiency would more readily be attained if it was possible to increase or decrease the strength of the curative agent, undertook to prepare, *in vitro*, a serum of known salvarsan content that could be safely administered intraspinally. Ogiloie gives the details of his method of preparing the serum for injection in the article. Essentially the method consists in the addition of a salvarsan solution, prepared as for intravenous injection, to fresh blood serum. To 15 c.c. of the serum the desired amount of salvarsan is added, an important point being that the temperature of the salvarsan solution and the serum should be the same when the two are mixed. The serum is gently agitated to thoroughly mix the two and is placed in a thermostat at 37° C. for forty-five minutes. From this it is placed in a thermostat at 56° C. for thirty minutes and is then ready to be administered intraspinally. This serum should be given as soon as possible after preparation and under no conditions should be used when more than three hours old. For repeated use Ogilvie has found that from 0.25 mg. to 0.5 mg. of salvarsan added to 15 c.c. of serum is the safest and most effectual dose to employ. He reports a series of

cases in which a total of 75 treatments were given. In 50 per cent. of the treatments there was no reaction of any kind beyond a slight temporary weakness. The remaining 50 per cent. had more or less severe reactions following the treatment, more marked in tabetics in whom lightning pains had been a prominent symptom. The author reports in detail a few of the cases treated on this plan. From a study of these cases it will be seen that the laboratory evidences of active syphilis, as shown by the Wassermann reaction in the blood, and the cell-count, globulin content and the Wassermann reaction in the spinal fluid, were reduced in every instance to a greater or less degree, and that, in the majority, there was a concomitant clinical improvement. As to the permanency of these changes Ogiloie holds a conservative view, since it is yet far too early to draw any definite conclusions. It seems reasonable to believe, however, that those cases that have responded favorably, both clinically and biologically, can be controlled with proper supervision and sufficient treatment. Ogiloie says that this method of treatment demonstrates the practicability of giving salvarsan in small doses intraspinally without jeopardy to the patient. He emphasizes the importance of keeping the dosage within 1 mg. The relatively small amounts of arsenic found in serum salvarsanized *in vivo* (according to the method of Swift and Ellis) suggests that its spirocheticidal properties are not wholly dependent on the salvarsan content, but probably also on the formation of some substances in the blood-serum, with the nature of which we are as yet unfamiliar. It was, therefore, in an effort to preserve, so far as possible, the principles of the Swift-Ellis method, that the plan of first incubating the serum at body-temperature for forty-five minutes was evolved.

Splenectomy in the Treatment of Pernicious Anemia.—JAGIC (*Wien. klin. Wnschr.*, 1914, xxvii, 1356) reports very good results in three cases of pernicious anemia where the spleen was removed for therapeutic effect. The general condition of these patients improved at once. The improvement obtained may be described as a symptomatic one as the blood still shows all of the characteristics of pernicious anemia. However, the patients feel well and strong and have gained respectively 17, 24 and 26 pounds in periods of time varying from seven to eleven months. In one of the cases reported there was a recurrence of symptoms after a period of improvement following the splenectomy. Under arsenic this patient again improved to a greater extent than before the recurrence. The author believes that the spleen has a marked influence on the course of pernicious anemia although abnormalities of the spleen do not have a direct causal relation to the disease.

The Effect of Theobromin Sodium Salicylate in Acute Experimental Nephritis.—CHRISTIAN (*Arch. Int. Med.*, 1914, xiv, 827) says that so far as renal function may be judged from phenolsulphonephthalein excretion in acute experimental nephritis produced by uranium in the rabbit, there is no evidence that theobromin sodium salicylate exerts any constant beneficial action. In the severer forms there is almost no evidence of beneficial action; in the very mild forms there is occasionally evidence of beneficial action but this is too inconstant to justify the conclusion that theobromin sodium salicylate really improves renal

function even in the very mild forms of acute nephritis. The results obtained in the rabbit are in accord with the common clinical teaching that diuretics are not indicated in acute nephritis in man; but they are no proof of the correctness of this teaching, for results obtained in rabbits cannot be directly read in terms of man. However, they would seem to lend some further support to the view based on clinical observation that diuretics are not indicated in acute nephritis.

OBSTETRICS

UNDER THE CHARGE OF

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Inversion of the Uterus.—MAXWELL (*Jour. Obst. and Gynec. Brit. Emp.*, January, 1915) reports two cases of inversion of the uterus. The first was a primigravida delivered under chloroform by forceps, who had hemorrhage three days after labor. A mass the size of a fetal head projected through the cervix into the vagina. There was retention of urine but no apparent septic infection. The hemorrhage was checked by rest and repeated douches, and the patient was so much better that she left the hospital. She returned several months later, as hemorrhage at the menstrual period had been so profuse that she had become alarmed. On examination, although the uterus had grown smaller, the fundus projected two and one-half inches into the vagina. The uterus was gradually replaced by applying Aveling's repositor under chloroform, varying the size of the cup applied. In forty-three and one-half hours the uterus was in its normal position. Following this the temperature rose to 103° F., and gradually subsided. The patient's recovery was complete, and no further pregnancy has occurred. The second case was a primigravida delivered three days previously by forceps, with some difficulty in the removal of the placenta. On examination a large fetid mass was found in the vagina and delivered externally. Its lower portion was covered with necrotic tissue, fibrin, and shreds of placenta, and the mass bled freely during examination. The uterus was completely inverted. After cleansing with hot solution the uterus was cautiously replaced by dilating the constricting ring and eventually carrying four fingers through the ring with the fundus. The complete replacing took about forty minutes. At first considerable force was used to dilate the constricting ring from below. There was very little shock. The patient remained in an exhausted condition, with symptoms of sepsis and a severe diarrhea, until the twelfth day, when she developed symptoms of pulmonary embolism in the left side. On the sixteenth day she had a sudden left hemiplegia and died in a few hours. No autopsy could be obtained, but a blood culture on the thirteenth day showed no positive growth. HEDLEY reports two cases of inversion of the uterus, at St. Thomas' Hospital, treated

by abdominal section and posterior incision of the uterus. The first was a multipara, delivered some six months before admission, who had an adherent placenta, which was partially removed by the hand, but the manipulation was suspended because of hemorrhage. The patient was in bed for six weeks after confinement, with a thick, yellow, offensive discharge. After getting up she had hemorrhages, with constant backache and headache. On examination the patient was profoundly anemic, the uterus was completely inverted, and around the attachment of the cervix to the vaginal vault was a collar of firm tissue, about one-half inch in depth, formed by the lips of the cervix. Under anesthesia an attempt was made to replace the uterus by pushing upward with one hand and making counterpressure through the abdominal wall with the other. This failing, the lips of the cervix were grasped by volsellum forceps, and pressure was made on the fundus, but without success. As the patient's condition was not good the abdomen was immediately opened and a further attempt made to reduce the inversion by manipulation. This also failing the constricting ring was divided posteriorly, when an assistant was able readily to reduce the inversion by slight pressure through the vagina. The wound in the uterus was closed with catgut sutures, from above downward, including the vaginal portion of the cervix, and the wound in the vaginal wall was closed in the same way. The hemorrhage stopped when the sutures were applied. As the uterus was flabby and dropped back into the pelvis, ventrofixation was done. The patient had moderate fever after the operation, but gradually made a good recovery. The second case was that of a primigravida, who gave birth to a child spontaneously, and the placenta was delivered a quarter of an hour later by expression. Soon after a tumor was seen in the vagina, severe hemorrhage occurred and the patient became unconscious. The tumor was recognized as the inverted uterus and immediately replaced. The patient was kept in bed for three weeks, but suffered from severe hemorrhage. This persisted after she got up, and there had been one attack of very severe pain in the pelvis three weeks after the birth of the child. On examination the patient was exceedingly anemic and the uterus found to be inverted. Manipulation being unsuccessful, the same operation done in the first patient was performed upon this, including ventrofixation. The patient made a good recovery without complications.

Uterine Fibroids Complicating Pregnancy.—Phillips (*Jour. Obst. and Gyn. Brit. Emp.*, January, 1915) describes six cases of fibroids complicating pregnancy and parturition. The first patient, aged thirty-three years, pregnant a few months for the first time, had a fibroid upon the posterior uterine wall, which was causing great irritation. It was readily removed by section, but the patient would not remain quiet and aborted some two and one-half months after the operation. The next patient, an unmarried woman, had three months of amenorrhea and a tumor extending above the umbilicus. On opening the abdomen the omentum was adherent, and when this was separated pus was discharged freely. The tumor was found to be a fibroid uterus broken down with suppuration. It was completely removed, the abdomen cleansed, and a large rubber tube inserted. The patient did well for two weeks and then had intestinal obstruction,

caused by the bowel becoming adherent to the scar. A second operation was performed, after which the patient did well. On opening the tumor a three months' pregnancy was found with suppuration at the attachment of the ovum. The interesting question arises, Had some attempt been made to produce an abortion and the fibroid become infected by that means? The third patient was delivered by forceps and made a good recovery until the twelfth day, when fever developed. Under an anesthetic a round tumor could be found, attached to the anterior uterine wall. The patient declined operation and gradually recovered. Two years later she was delivered of a second child and made a normal recovery. No trace of the tumor could be found by vaginal examination. The fourth patient was a multipara, who had hydramnios, manual removal of the placenta, and postpartum hemorrhage. After she recovered from confinement she had a foul vaginal discharge, with fever and quick pulse. On examination a dark, offensive, globular mass, as large as a man's fist, was found in the uterus. This was removed under anesthesia and proved to be a sloughing fibroid. The patient made a good recovery. In the fifth patient, a multipara, a fibroid tumor was recognized at labor. The patient suffered after her recovery from parturition with frequent hemorrhage. When the uterus was removed it was found to be fibroid with beginning malignant change. The sixth patient at her confinement was found to have a fibroid in the anterior wall of the uterus. Her recovery was apparently normal. After eight days vomiting occurred, with sudden and marked distention of the abdomen. At operation coils of the small intestine were found adherent to the fibroid in the anterior uterine wall, which had undergone degeneration. The bowel was separated and hysterectomy performed. The patient made a good recovery. The writer points out the fact that hysterectomy is not advisable in every case. Patients having fibroids repeatedly bear children successfully. When the diagnosis is made the patient should receive constant attention and be under observation. The patient should be warned that the presence of the fibroid adds considerably to her danger. If symptoms of degeneration in the tumor occur, operation should be done at once, myomectomy being chosen, if possible. If the tumor is where it will render spontaneous labor difficult or dangerous the patient may be given a chance to go to viability or term and have Cesarean delivery, followed by hysterectomy. If the fibroid is causing no symptoms, and not likely to interfere with delivery, the patient may be allowed to come into labor, but she will require assistance in labor and complications may arise in the third stage. In most cases operation should be advised after recovery from parturition.

A Fatal Case of Rupture of the Uterus.—Fothergill (*Jour. Obst. and Gynec. Brit. Emp.*, January, 1915) reports the case of a woman, who had had nine previous confinements, delivered at home by version for transverse position. When removing the placenta a rent was discovered in the right side of the uterine wall. On admission to hospital the patient was in collapse from hemorrhage. There was no urine in the bladder and no rigidity of the abdomen. On section a tear in the peritoneum extending forward to the right of the bladder on the anterior abdominal wall and backward nearly to the right kidney was found.

The bladder was separated from surrounding tissues except at the base. The uterus was still attached on the left side, but the cervix and lower segment on the right were badly torn. So great was the laceration that the cecum and appendix were torn from their attachments, and it was easy to remove the uterus entire. An effort was made to draw together the peritoneum and a gauze drain was placed in position. The patient rallied slowly, urine was secreted and voided naturally, but on the evening of the fourth day there were chills, and death occurred on the sixth day. At autopsy an abscess cavity in the pelvis shut off from drainage was found. There was no general peritonitis. The bladder was uninjured; the right ureter could not be traced. The cecum and appendix were normal. Although it is not definitely stated, it is probable that version was attempted in this case without complete anesthesia, because the parts were greatly dilated and relaxed. Abundant experience shows that severe laceration is inevitable when version is attempted without the relaxation secured by complete anesthesia, hence in cases of transverse position the procedure should be considered an operation of magnitude sufficient to secure a competent anesthetizer.

Scopolamin-Morphin Amnesia.—Polak and Beach (*Am. Jour. Obst.*, May, 1915) publish papers giving their experience with this method. As regards doses, Polak rated the dose by the condition of the patient, using but one dose of morphin hydrochloride. In this way he thinks he avoided cyanosis in the infant. In 155 cases there were three failures, 150 had no recollection of labor after the second injection, a few had intervals of memory; 10 per cent. had delirium during the stage of pressure on the perineum. There was no fetal mortality. The percentage of patients requiring delivery by forceps was low. There was no postpartum hemorrhage and apparently the secretion of milk was not influenced. In expert hands, in maternity hospitals, in selected cases, the method has usefulness in the first stage of labor. Beach gives the results in 876 cases, in 90 per cent. of which there was some relief from labor pain; there was complete absence of memory regarding labor in 75 per cent. It is a mistake to apply the method to patients first seen when late in labor. So great is then the disturbance that the drugs do not act in the manner desired. Beach considers the method one in which to get the best results it must be used in ideal surroundings with minimum possible doses, and by some one who has trained himself to do this work.

Pregnancy Complicated by Myxedema.—Nyulasy (*British Med. Jour.*, June 19, 1915) describes the case of a primipara, eight months, with albuminuria and myxedema. The patient had a deformity of the spine which lessened the capacity of the pelvic brim. She was apathetic, remaining in bed most of the time, and redness appeared on the skin over the lumbar region from pressure. The patient was delivered by section. The child was macerated and breathed for a short time feebly. The patient's ovaries were apparently normal, but the subcutaneous fat was very tough, pale, fibrous and tightly bound down. The patient speedily made a good recovery.

GYNECOLOGY

UNDER THE CHARGE OF

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Bulgarian Bacillus in the Treatment of Alkaline Cystitis and Pyelitis.—A very favorable report is given by HAGNER (*Surg., Gynec., and Obst.*, 1915, xxi, 95) on a method of treatment originally suggested by Caulk for these very troublesome conditions by means of instillations of a suspension of lactic acid bacilli. Numerous attempts have been made in the past to render the urine acid in cases of severe cystitis associated with alkalinity of the urine, but usually without much success. Chemical substances injected are soon washed out, and attempts to inoculate the Bacillus coli communis have usually resulted in failure, this organism being overgrown by the proteus vulgarus, which is usually present in these cases. The lactic acid bacillus is, however, as is well known, extremely resistant, and is itself able to overgrow and destroy many other types of organisms. It was upon this theory that Caulk originally suggested its use in the treatment of alkaline cystitis. Hagner has tried it in a number of cases of bad cystitis, and in one of a right pyelitis with alkaline urine, and has been exceedingly pleased with his results. The method of application is exceedingly simple. The bladder is first irrigated with sterile water, as any antiseptic solution might interfere with the growth of the bacillus; three or four of the commercial bulgarian bacillus tablets are then dissolved in an ounce of sterile water, well stirred, and injected into the bladder, the patient being told to retain the fluid as long as possible. This process repeated for three days will usually, the author says, transform an offensive alkaline urine into an acid one, with corresponding rapid amelioration of symptoms. In the pyelitis case the infecting organism seemed to be the Staphylococcus aureus, purulent alkaline urine, containing this in pure culture being obtained from the right kidney, while that from the left was but faintly alkaline, and contained but a small amount of pus. The right kidney pelvis was injected with 7 c.c. of 4 per cent. silver nitrate solution, but two days later the urine still contained pus and was alkaline. Two bulgaricus tablets were then dissolved in 10 c.c. of sterile water and injected through the ureteral catheter. At the end of thirty-six hours the patient had a chill, and rise of temperature to 103.5° but dropping to normal in twelve hours. The following day the urine was acid; two further injections were given into the bladder, but not into the kidney; after three months the urine remains clear, acid, and free from pus.

Thorium, a New Agent for Pyelography.—A few months ago we spoke of the desirability of obtaining some substance capable of throwing a Roentgen-ray shadow when injected into the kidney pelvis, and yet perfectly harmless under all circumstances to the renal tissue, conditions that are not entirely fulfilled by collargol, and similar

preparations which are chiefly used for this purpose at present. From the Urologic Department of Johns Hopkins there has recently come a report by BURNS (*Jour. Am. Med. Assn.*, 1915, lxiv, 2126) on the use of thorium for pyelographic work. Thus getting away entirely from the silver preparations, some form or another of which have been used by most previous workers. Thorium nitrate, the author says, dissolves readily in water, giving a clear markedly acid solution, which is opaque to the Roentgen rays, but is too irritant for use in the bladder. The neutral solution of thorium nitrate and sodium citrate, however, seems to possess the important characteristics of being non-toxic, non-irritant, and fluid, so as immediately to escape from the ureters and bladder, while at the same time casting a clear, distinct Roentgen shadow. It is perfectly clear to transmitted light, possessing in large volume a faint yellowish tinge. It is much cheaper than the silver preparations, an advantage when it must be used in large quantities for bladder pictures or large hydronephroses. The solution now being used is made as follows: "Ten grams of thorium nitrate are dissolved in as little distilled water as possible, to this solution, kept hot on a water or steam bath, are added 30 c.c. of a 50 per cent. solution of sodium citrate, the additions being made in small quantities, and care being taken to shake the solution thoroughly after each addition. At first after the addition of the citrate solution, a white gummy precipitate is formed which later becomes granular, and finally dissolves on the addition of all the citrate solution. This solution is then made neutral to litmus by the careful addition of a normal solution of sodium hydroxide, and made up to 100 c.c. with distilled water. On filtration, a clear, limpid solution is obtained, which, when sterilized, either by boiling or steam under pressure, is ready for use. The stability of the solution is not affected in the least by sterilization." Burns states that this solution is now being used in all their suitable urologic cases, and appears to be perfectly innocuous. It gives excellent shadows, as the photographs accompanying the article testify.

Urinary Incontinence in the Female due to Diverticulum of the Urethra.—An exceedingly interesting case of this rather unusual condition has recently been reported by JARECKI (*Ztschr. f. urol. Chir.*, 1915, iii, 241). The patient was a girl, aged twenty-one years, a nullipara, who had complained of incontinence since early childhood. The incontinence was not complete, but occurred on laughing, coughing, or making sudden movements of any kind, particularly if the bladder was at all full. Even at night, however, during deep sleep involuntary micturition often occurred. The act of voiding was never accompanied by burning or pain. Cystoscopic examination revealed what appeared at first to be a perfectly normal bladder, with a good sphincteric ring. Just as the examiner was about to conclude that the findings from this stand-point were entirely negative, however, the sphincter was seen in the cystoscope to dilate appreciably, so that the instrument could be drawn out into a distinct saccular dilatation of the proximal urethra, or "Vorblase," as the author calls it. This was at least the caliber of the thumb, lined with smooth mucosa, but with a somewhat trabeculated wall. It was possible to examine this sacculation only for a moment, the walls almost immediately falling

together again. It was found, however, that if the patient was told to make an effort to void urine with the cystoscope in place, the sacculation immediately reappeared, the sphincter opening wide, and the sac again filling with urine. From these findings the conclusion was reached that the incontinence probably had two factors in its causation: (1) a weakness of the vesical sphincter, this being especially important when the bladder was overfilled, and (2) an emptying outward of the urethral diverticulum, this occurring usually shortly after completed micturition. It appeared evident, therefore, that in order to cure the condition both these factors must be dealt with. Attempts were made to effect a cure by various procedures, four separate operations being required before a satisfactory result was obtained. All efforts to simply plicate or infold the dilated portion of the urethra, without opening and resecting a portion of it, proved failures, and eventually it became necessary to make a longitudinal incision through the anterior vaginal wall and through the wall of the sacculated urethra, excising a portion of the latter, and closing the opening with sutures passed not quite through the mucosa. A piece of fascia lata 4 mm. broad was then excised, and wrapped completely around the proximal portion of the urethra, the ends being united with catgut sutures. At a previous operation a circular suture of silk had been passed about the neck of the bladder through a supra-pubic incision, in the attempt to strengthen the action of the sphincter. The final result is reported by the author as entirely satisfactory, the patient having regained complete control of her urine, a condition which has lasted two years since operation. Jarecki thinks the origin of the trouble was probably a primary weakness of the vesical sphincter, which permitted a filling of the proximal portion of the urethra whenever the bladder became distended, involuntary passage of this urine being prevented at first, however, by the action of the smooth and striped muscle of the urethra. With the gradual dilatation of the posterior portion of the urethra that occurred under these conditions, the sufficiency of these auxiliary muscles became impaired, and thus the condition of partial incontinence developed.

Ovarian Sarcoma in Children.—Three cases of large sarcomatous ovarian tumors occurring in young girls are reported by HIGGINS (*British Jour. Child. Dis.*, 1915, xxi, 161). The first case was in a child, aged five years; a swelling had been noticed in the abdomen for six weeks, and the child was obviously extremely ill on admission to the hospital. Blood was passed in small quantities from the vagina. On opening the abdomen a tumor weighing three and one-half pounds was found springing from the right ovary, the other being apparently normal. The tumor was removed, and proved histologically to be a mixed-cell sarcoma; operation was followed by Roentgen-ray treatment for thirteen weeks, at the end of which time the child appeared entirely strong and healthy. The second case was a child, aged ten years, from whose right broad ligament a hard tumor the size of a cricket ball was removed by operation. In this case a lump in the abdomen had been noticed about five weeks previously. This tumor likewise proved to be a mixed-cell sarcoma; over two years later, however, the child was still in perfect health. The third case was a child, aged

seven years, in whom a solid tumor the size of a cocoanut was found at autopsy; this neoplasm grew from the right ovary and weighed five and three-fourths pounds. It had burst through its capsule and invaded the adjacent omentum, intestines, and liver, but there were no glandular enlargements or distant metastases. Microscopically it proved to be a round-cell sarcoma. In this instance the child's illness had been of four or five months' duration, and no attempt had been made to remove the tumor by operation. The author calls attention to the fact that in all these cases there was an insidious onset of symptoms, with unexplained colicky pain, and later the appearance of a mobile lump in the abdomen, with steady enlargement of the latter, and pain and fever, the result of adhesive peritonitis. He considers these tumors entirely analogous in genesis to the much more common malignant kidney growths, and avises immediate operation in every instance as soon as even a provisional diagnosis is arrived at.

OTOLOGY

UNDER THE CHARGE OF

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Physiology of the Labyrinth Windows.—In accordance with the observations of Kessel, Panse, and Bárány and others, MAURICE (*Arch. internat. de laryng.*, 1914, xxxvii, 2) refers the improvement in hearing consequent upon the application of a cotton artificial drumhead, over the round window, to the physiological functions of the two labyrinth windows, the one supplementing the other by the reverse movement of its membranous structure in response to the impact of a sound wave. When a sound falling upon the membrana vibrans, and transmitted through the ossicular chain, reaches the membrane of the oval window and meets the resistance of the incompressible intralabyrinthine fluid it can proceed no further except that the membrane of the round window, moving consonantly outward, permits transmission of the movement actuating the membrane of the oval window, through the mass movement of the otherwise acoustically immobile fluid. If the sound wave passing through a perforation in the membrana vibrans falls equally, and coincidently, upon the membranes of the two labyrinthine windows there will be no resultant sound perception because of the lack of provision for mass movement in response to an unilateral impact; if, however, the sound wave impact is shut off from one or the other window the primary and secondary movements of the window membranes are facilitated and, with the consequent molar movement of the intralabyrinthine fluid, the cochlear end apparatus is actuated and the sound perceived. In the practical application of the cotton artificial drumhead soaked in melted vaseline, or albolene, a minimum pressure

should be exerted upon the membrane of the round window as compared with that brought to bear upon the stapes or the membrane of the oval window; care should also be taken to leave no enclosed air space between the membrane of the window and the cotton tampon, the space in question acting as a resonance chamber and serving therefore to reinforce certain tones and give the effect of autophany. The peculiar variations in hearing incident to suppurative processes in the middle ear, with perforation of the drumhead, and especially the better hearing when the middle ear is moderately moist with discharge, is accounted for by the fact that the presence of the fluid, in the more dependent portion of the cavity, somewhat inhibits the movement of the membrane of the round window and leaves it free to respond, correlatively, to the impulse received at the oval window and transmitted through the medium of the intralabyrinthine fluid.

Aural Sounds of Muscular Origin.—The observations of DEDEK (*Monatschr. f. Ohrenh.*, 1914, xlviii, 3) upon both subjective and objective noises in the ear, of muscular origin, include not only the intrinsic muscles of the sound transmitting apparatus of the middle ear, but also those having their origin in the movement of the palatal and tubal muscles especially, but occasionally resulting from the action of such extraneous muscular bundles as the attolens and attrahens auriculæ. One illustrative case had its origin in spasmodic contraction of the pharyngeal muscles developing as the result of a traumatic neurosis and comparable to the sound of the ticking of a watch or the snapping of the finger nails, recurring as often as one hundred and forty times in a minute, multisynchronous neither with the patients pulse nor breathing, and audible, in stillness, at a distance of five meters. There was no determinable movement of the membrana tympani but distinctly visible movement of the soft palate accompanied by similar movements of the neck and, sometimes, of the face muscles, all of these movements being synchronous with the objective sound. Checking of the palatal movement, holding the breath, depression of the tongue or tickling of the nasal mucous membrane caused a cessation of the muscular activity and consequently of the produced sound but catheterizing or even bougieing of the tympanopharyngeal tube had no similar effect. Inspection of the faucial opening of the tube during the production of the sound showed a very slight vertical movement of the wide open tube. The psychic condition of the patient had an evident influence upon the intensity of the sound produced and the muscles principally implicated were the tensor and levator veli in addition to the salpingopharyngeous.

Subsequent Dressings of Mastoid Operations.—WEISSMANN (*Rev. hebd. de laryng.*, 1914, No. 19) practices, and advises, as the best method of after-treatment of mastoidectomies, whether acute or chronic, whether the antrum be opened or the mastoid cavity completely evacuated with inclusion of the bony wall of the middle and posterior fossæ, primary closure of the postaural wound without drainage. The exceptional cases are those in which an intracranial complication has to be considered, an extradural abscess or possibly a wound of the sinus; these cases are, primarily, to be packed, but the tampons omitted so soon as there is

no longer danger of hemorrhage or other complication. The stitch closure of the postaural wound is also contra-indicated in cases of coincident subcutaneous abscesses, infiltration and maceration of the dermis and in the presence of fistulous openings; even under these conditions the author dispenses with packing and applies only a superficial dressing and bandage. In the cases of primary closure if, at the end of eight days, the ear is not becoming dry and the postaural wound is not in good condition the stitches should be removed and the wound opened and drained. The author further advises the primary and complete closure of the postaural wound in the radical operation, as well as in the simple mastoid exenteration and also the omission of gauze wicks in the external auditory canal. On the fifth or sixth day the bandage and dressings are removed and, if there is much discharge or offensive odor, the wound is syringed with boiled water to which a moderate amount of hydrogen dioxide is added; on the eighth day the stitches are removed and on the tenth day the postaural bandage is dispensed with and the subsequent treatment is that customarily applied to an uncomplicated suppurative process in the middle ear with frequent mild antiseptic cleansing followed by insufflation of boric acid powder and similar substances. All of the cases of this class should be continued under careful and stated observation in order to attain the best results. The contra-indications to a primary stitch closure of the postaural wound in the cases of radical operation and the precendent application of gauze packing are the same as in cases of the simple mastoid operation.

PATHOLOGY AND BACTERIOLOGY

UNDER THE CHARGE OF

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Butyric Acid Sclerosis of the Arteries.—Metchinkoff claimed that the products of bacterial fermentation in the bowel were important factors in causing a chronic intoxication and arteriosclerosis. He was able to demonstrate the effect of paracresol in this manner. The importance of this intoxication, he believes, does not lie in heavy individual doses, but rather in the cumulative effect of the absorbtion of small quantities. In a similar manner Dratchinski was able to experimentally reproduce arterial lesions by feeding small quantities of indol over a long period

of time. Following a suggestion by Metchinkoff, COLEMAN (*Ann. de l'Inst. Pasteur*, 1915, xxix, 139) studied the effect of butyric acid absorbed from the bowel upon the arterial system. He points out that different quantities of butryic acid are found in the intestinal contents, the quantity in some individuals being much higher than in others on account of bacterial decomposition. Certain anerobic bacteria (B. Butyricus, B. Welchii, B. sporogenes) are particularly prone to produce butyric acid in the intestine. A fair amount of this acid is absorbed and appears in the blood. Nine guinea-pigs were carefully studied and four of them were found with "cartilaginous" plaques in the aorta. Calcareous masses were not present in any of the arteries or organs. His figures agreed with those of Dratchinski who found that 50 per cent. of the guinea-pigs had "cartilaginous" plaques in the arteries. Coleman then attempted to feed guinea-pigs with butyric acid and found that it had to be greatly diluted to prevent gastric disturbances. The calcium butyrate is still more poisonous than the acid itself. 0.5 c.c. of a 12.5 per cent. solution of caclium butyrate were given by the mouth. In another series small doses of butyric acid were given. The experiments were continued from twelve to twenty-nine weeks. Calcification of the aorta was commonly found in these cases associated with calcareous deposit in the kidneys. Sclerosis was also present in the arteries of different organs. The changes in the aorta were accompanied by a fatty degeneration of the muscle cells, as well as a sclerosis of the vasa vasorum. He believes that these organic changes are the direct result of the butyric acid or its salts.

Syphilitic Leptomeningitis.—Very little attention has been given to the syphilitic lesions of the meninges unless gummata were present. Types of pachymeningitis of syphilitic origin were also recognized, but it was not until in 1908, when Duerck reported five cases of acute syphilitic leptomeningitis, that attention was attracted to this subject and active discussion begun. On the whole, the type described by Duerck was rather unusual. LE COUNT and DEWEY (*Jour. Infect. Dis.*, 1915, xvi, 142) studied the leptomeninges in a series of autopsies with the view of noting the presence of meningeal change in undoubted cases of syphilis as well as for the recognition of lesions of the meninges in conditions other than syphilis. They recognized three main types of changes in the pia: (1) opacity, (2) patches of fibrous thickening, (3) discreet focal lesions. Opacity of the pia is commonly present in a great variety of diseases. Its distribution is variable as is also the amount of opacity. Patches of fibrous tissue in the pia are not uncommonly associated with opacity and the two appear related. The focal lesions are more commonly seen at the base on the under surface of the frontal and temporal lobes and the pons and cerebellum. Vascular changes at the base were not infrequent, while pial hemorrhages were found in several cases. The nodular type of meningeal change is the one deserving particular attention, in connection with syphilitic meningitis. In all, the authors have described fifty-five cases. They concluded that the finding of meningeal lesions of a focal character necessitates the exclusion of syphilis as a cause before suggesting other infections as the etiologic factor. Such nodular lesions of the meninges should be given a value equal to lesions in other places as the aorta

or liver for the final summing up of evidence for syphilitic infections. The arachnoid scars show that this membrane is one of the few places where organisms find conditions favorable for a limited multiplication after generalized spirochetemia. They point out that the evidence that alcohol may produce a fibrous meningitis is inadequate.

The Mechanism of Phagocytosis.—Much has been taken for granted in our conception of the manner in which animal cells ingest solid particles and the work of recent years has concerned itself with the more intricate points of bacterial destruction within the bodies of leukocytes. KITE and WHERRY (*Jour. Infect. Dis.*, 1915, xvi, 109) suggest that foreign particles are taken up by leukocytes because the latter have sticky surfaces. These particles adhere to the cell and are carried into the interior by cytoplasmic streaming currents. This mode of dealing with foreign particles can be observed in the amebæ of the limax group, which, while in the trophozoit stage, are provided with sticky surfaces. These amebæ while in the motile flagellate stage are not sticky. The effect of opsonins upon bacteria is to cause their outer surface to become sticky. The authors repeated a number of tests with opsonins and found that when separately incubated mixtures of leukocytes and serum and serum and bacteria are agitated together, many of the bacteria stick to the leukocytes and are rolled into their substance. Such bacteria undergo digestion. Experiments with a minimum amount of agitation show that phagocytosis is reduced. They believe that bodies similar to bacteria stick to leukocytes best in the presence of unheated serum because they absorb something from the serum which makes them more sticky and hence their chances of adhering to the surfaces of the leukocytes are increased.

Multiplicity of Tumors.—EGLI (*Cor.-Bl. f. schweiz. Aertze*, 1914, 449) studied the autopsy material of the Pathological Institute of Basle. In 4765 post mortem examinations, 966 tumors were found and of these 263 (27.2 per cent.) showed the presence of multiple tumors. The author classifies the various combinations of multiple tumors. He believes that the presence of multiple tumors is accidental and that there is no influence exerted by one type to induce the appearance of another. There was also lack of evidence of a predisposition for either benign or malignant tumors. The nature of a tumor is dependent upon the character of the cell component as well as the influence of the surrounding tissues. These two factors appear to guide the growth of tumor masses toward the benign or malignant types.

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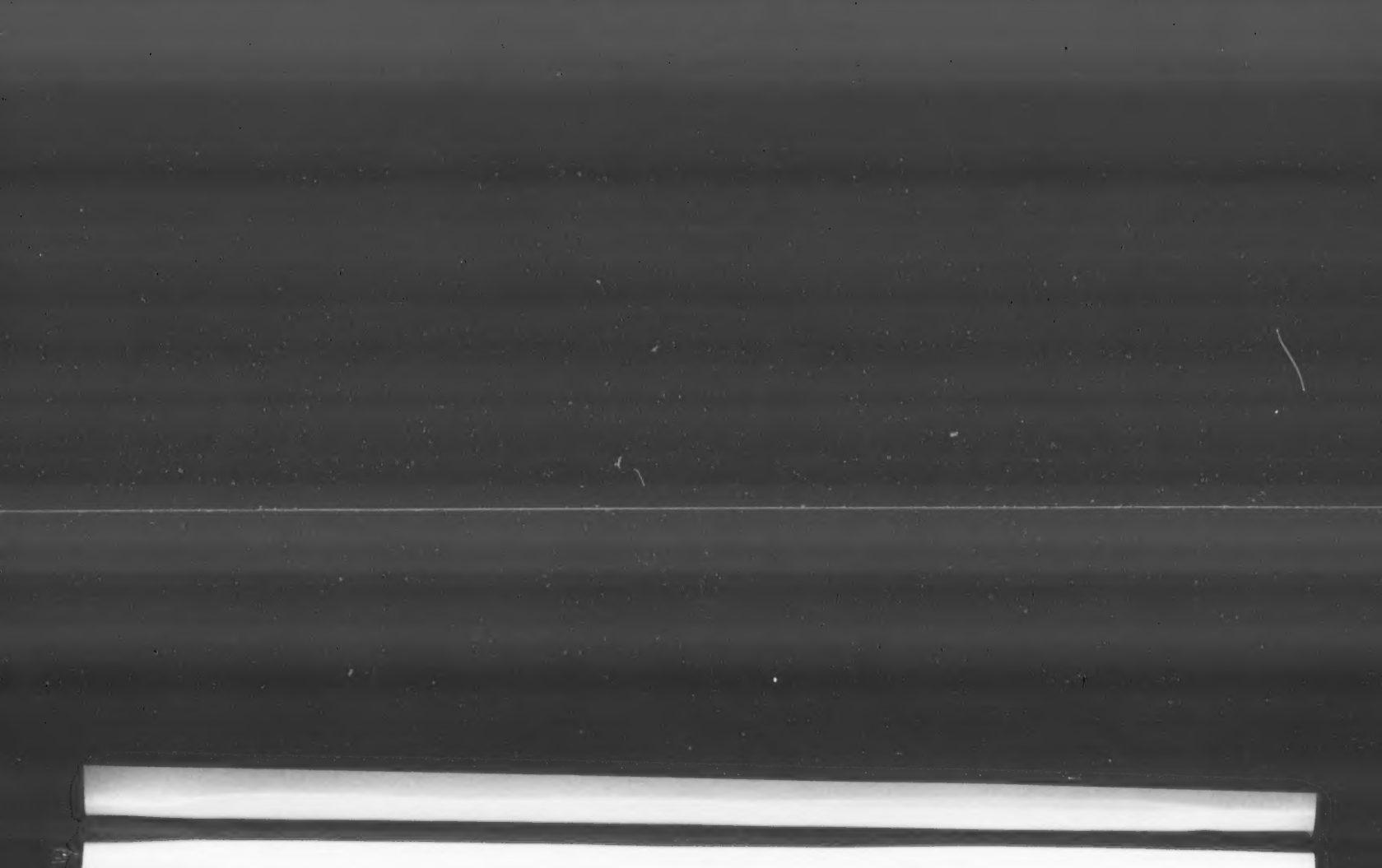

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